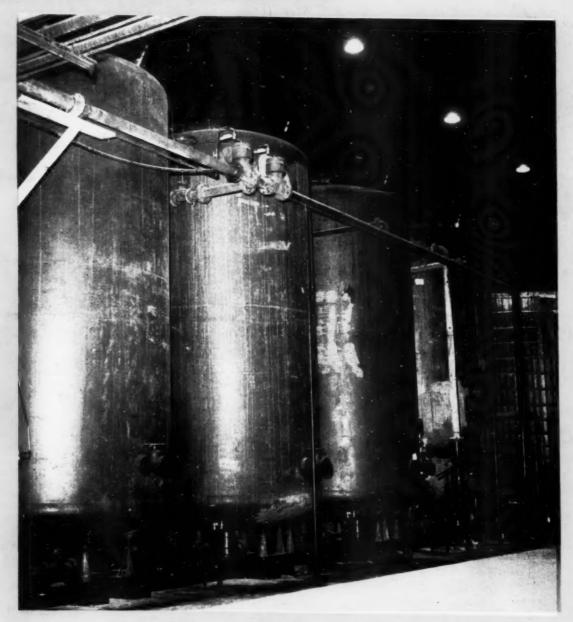
# MINING WORLD



Mucking Out Behind The Iron Curtain Page 42

How Holly Minerals Treats Complex Hg-As Ore Page 53



Dawn Recovers Uranium By Columnar Ion Exchange

it's the EXTRA JIGOLE that counts!

# The Wemco-Remer Jig provides:

- Better Stratification
- Uniformity of Jigging Action
- · Accelerated Settling of Heavy Fines
- Faster Hutching of Fine Concentrates
- Greater Capacity
- Maximum Efficiency
- Freedom from Sanding or Dead Spots

Because of these factors, you are able to treat size ranges never before efficiently jigged . . . with concentration even in the finest sizes.

These Jigs have been repeatedly chosen after competitive tests and complete evaluations to determine the most economic means to concentrate the minus ¼" portion of feed in Iron Ore Heavy Media plants.

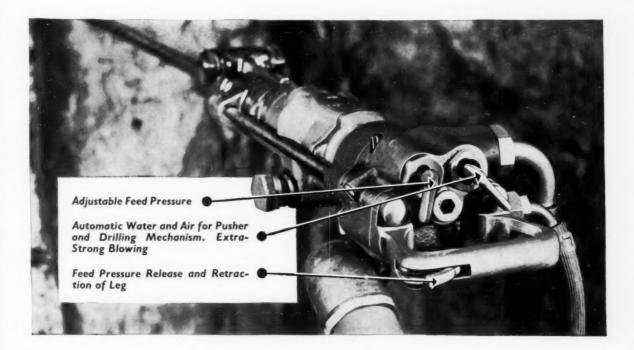
Before deciding on your fine ore treatment method, investigate what Wemco-Remer Jigs are doing for others.

With other Jigs, there is only one stroke. It's the Extra Jiggle in the Wemco-Remer Jig that makes the difference. For more details, send for free bulletin J2-B3.

Representatives in principal cities in United States and Canada and in major countries throughout the world.



WESTERN MACHINERY COMPANY



# THE ATLAS COPCO LIONA REVOLUTIONARY NEW ROCK DRILL

#### All controls under one hand

The Atlas Copco Lion is the first drill to have all the valves which operate the drill under the control of one hand. Full and easy control without having to move the hand from the backhead! All the controls have been designed so that they are well protected. While using them the operator's hand is never near the wall or roof of the drift. The Lion is the first pusher leg drill with controls placed for drifting.

#### Retractable leg saves time

When the leg has to be moved the feed pressure is easily released by squeezing the hand grip. By further pressure on the grip the leg retracts automatically. When the leg is in the new position suitable for continuous drilling, retraction stops and the feed pressure comes back by loosening the grip of the hand. All this can be done while the drill is still running.

This new idea of a retractable leg enables quicker repositioning of the leg and reduces the number of steel changes, thereby increasing footage per manshift. When drilling high holes it is now far easier to alter the position of the leg more frequently in order to maintain an optimal feed angle and feed pressure.

## Packed with power for deep holes

The Lion has a drilling rate at least 30% higher than other rock drills of the same weight. Furthermore, it can maintain its high speed even when drilling deep holes. This means quickly drilled deep hole rounds and a faster advance. The Lion also reduces to a minimum the gauge wear of the bits in abrasive rock. And owing to the ease with which the feed pressure is released and brought back into action, the Lion is a handier drill to work with in fissured rock.

#### Sandvik Coromant-the steel for the Lion

All Atlas Copco drills—and this goes for the Lion too—have been developed from the earliest stages with Sandvik Coromant tungsten-carbide-tipped integral steels and detachable bits. This combination pioneered tungsten carbide drilling in the early forties. No drill or steel developed separately could ever give such equivalently high performances as this drilling combination. Today it is the most widely used in the world, responsible for drilling more than 1,000 million feet annually.

For further information on the Atlas Copco Lion rock drill, and details of sales and service, please contact:

u.s.—Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California, or Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA—Atlas Copco Canada Limited, Montreal Airport, P.Q.

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# Atlas Copco

D5374

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every metallurgical chemical you require ...
plus comprehensive technical service ...

in one complete package!

Cyanamid dependably supplies the widest selection of flotation and cyanidation reagents available from a single source!

You can safely minimize inventories, simplify purchasing with consolidated orders and frequently lower shipping costs.

And when you deal with Cyanamid, you can also get valuable in-the-mill help from our field engineers . . . experienced men who are kept currently informed on ore-dressing developments throughout the mining world.

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AEROSOL® Surface-active Agents

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AMERICAN CYANAMID COMPANY

MINING CHEMICALS DEPARTMENT 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

# Mining World

Including the Export Edition WORLD MINING

Published monthly except in April when publication is semi-monthly

VOLUME 20

#### FEBRUARY 1958

No. 2

#### OPERATIONS-TECHNOLOGY

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Dawn Uranium's New Mill Uses Columns For Ion Exchange . . . . . 34
By Don Hargrove

Newmont Mining Corporation's subsidiary operates 440-ton per day mill at Ford, Washington. It is one of first United States mills to use columns for lon exchange. The circuit features split-agitation and acid extraction of uranium from ore.

How Pb-Zn-Cu Are Separated By Differential Flotation ...... 49
By Frank W. McQuiston, Jr.

A world-wide review on methods used by companies in United States, Canada, Peru, South West Africa, Mexico, and Australia to separate mixed lead-zine-copper ore by differential flotation. Reagents and their consumption are detailed.

Holly Minerals Develops New Three-Step Mercury Process . . . . 53
By Ernest Oberbillig, James Fyfe, William Aitkenhead, and
John Jaekel

Furnacing of mercury ores containing arsenic and antimony has always been difficult. The authors have perfected a method to float cinnabar, leach floatation concentrate with sodium sulphide to produce water soluble mercury salt, and then to electrolytically precipitate the mercury.

# Mining

This special report details Soviet mine planning and mechanization, A detailed table shows characteristics of all types of loading machines, Many of the Soviet machines and methods show great similarity to machines invented and perfected in the Free World.

# Sampling and Tonnage Estimation

Auger drilling on 200 foot centers took samples. These were assayed, checked for gravity, and used for metallurgical testing. Five ore grade zones were established and tonnage calculated from cross sections.

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#### ON THE COVER

The four 8-by 15-foot ion exchange columns at Dawn Mining Company's uranium plant at Ford, Washington are shown on the cover this month. The Dawn plant is one of the few in existence in the United States which uses column equipment in the IX section.



### MILLER FREEMAN PUBLICATIONS





# JUY quick opening SHFAVE RINCKS

with the Locking Pin that can't be lost!

Only Joy Sheave Blocks have the exclusive non-removable locking pin that—

1

Can't possibly loosen and fall out when locked in place

2

Loosens by non-removable key when sheave must be opened.

3

Hangs by a flanged end of locking key, never is removed completely from the sheave to be lost in the muck pile.



#### OTHER FEATURES-

- Sealed-for life bearings—keep lubricant in, dirt and water out.
- Quick-opening snatch block construction
- Large throat opening
- Wheel recessed into side plates—prevents binding, reduces wear
- Chrome nickel molybdenum heat-treated sheave wheel
- Available in 6", 8", 10", 12", 14", and 20" sizes with safety hook, swivel hook, eye-bolt, or clevis attachments.

Write for FREE Bulletin 46-8

JOY MFG. CO.

Henry W. Oliver Bldg. Pittsburgh 22, Pa.

WEW M5030-46

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High dumping angle and smooth body interior sheds the load fast and clean . . . note distance of rear body chute from wheels.



Body is heavily reinferced to withstand heavy service . . . simple, rugged construction of "Eucs" keeps maintenance costs low.

# More Ore on the Mesabi is Moved in "Eucs" ... and always has been!



Rear-Dumps of 40 and 50-ton capacities are powered by two engines providing a total of 470 to 670 h.p.—each engine drives one of the tandem axies through a separate torque converter and semi-automatic transmission.

MINNESOTA'S IRON RANGE is a tough proving ground for off-highway hauling equipment. Loaded by big shovels, trucks haul ore and rock in all kinds of weather—often on steep grades and long, difficult hauls. They've got to maintain production at low operating and maintenance cost or they don't stay on the job long.

For over 20 years Euclids have moved far more tonnage on the range than all other competitive makes. Mine operators know from years of experience that they can depend on "Eucs" for long

life in heavy service—with low operating and maintenance expense. That's why Euclids are "standard" equipment on so many mine and quarry operations—with over 1300 Rear-Dump "Eucs" of 15 to 50 tons capacity working in Minnesota alone.

Have a Euclid dealer give you information on the complete line of rear-dump and bottom-dump haulers, scrapers and crawler tractors. He'll help you with your hauling problems and show you why Euclids are your best investment.

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio



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Equipment

OR MOVING EARTH, ROCK, COAL AND ORE



# Mining World

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# Drifts and Crosscuts

Learn To Speak Russian

We can only echo the recent words of one leading English geologist when he said "I wish to God that I could read Russian." It is now a well recognized yet amazing surprise to many to learn that the details of the Sputniks had been carefully documented in a Soviet amateur Radio Magazine in July 1957. No one in the United States was interested enough to have it translated by the few who could do it.

Dr. Rosu's article on Soviet mine mechanization in this issue gives us some insight into developments and methods behind the Iron Curtain. This must only be the top skimming of a great series of technical Minerals Industries articles in many Soviet publications.

Yet of greater importance is the fact that if there is one written technical source of everything printed in all languages, it is now in Russian. This is the direct result of the Soviet government's enormous project of making readily available to all Russian mining engineers, metallurgists, and geologists all the important articles printed in every leading technical magazine in the world. The engineers can read all about developments in every country in one of the low-cost state-subsidized technical journals. A special series of text books is also printed by the "Publishing House for Foreign Literature." These text books contain references to material written in other languages as late as six months before printing. Editions appear to have a minimum run of 10,000 copies. Much attention is given to books for prospectors and such books contain both academic and practical details.

Here in the United States, and probably in the Free World, there is no such system of collection, translation, and publication. However, the Canadian mining industry and government are taking advantage of Russian results and are sending 30 engineers, geologists, mineralogists, metallurgists etc. back to school for a 25-week Russian course. This will enable them to check Russian publications in the future to prevent duplication of study and research.

Not a bad idea for the United States mining industry to

#### Want More For Your Money

The recent New Year's message to his staff from the head of a large mining company contained the challenging phrase "I still have faith, but I would like to see more for my money.

We wouldn't be in the mining business if we didn't have faith-particularly at a time such as this with productive capacity stimulated ahead of consumer capacity.

How to get more for your money-in this case, by a small mining company-has been pointed out by Dr. Bahngrell W. Brown of the Montana School of Mines faculty in the school's paper De Re Metallica. Dr. Brown points out that "The most inexpensive and best qualified technical assistance it can possibly hope to command is the graduate student who is writing a thesis under faculty supervision. University fellowship is not charity but necessity." This applies equally to the training of young engineers under the guidance of established consulting



Handling materials by crane or locomotive?

Read how Pacific Northwest Alloys switched to Michigan Tractor Shovels and . . .

# SAVED \$5,000 PER MONTH!

# The Background

Pacific Northwest Alloys, Inc., a wholly-owned subsidiary of Chromium Mining & Smelting Company, Ltd. of Sault Ste Marie, Canada, produces an alloy known as low carbon ferro chrome from African, Philippine and Canadian ores. This new, fast-melting alloy is used in production of some of the new low carbon stainless steels.

## The Problem

Raw materials, such as chrome ore, limestone and quartz, are stockpiled outside the plant. Formerly, locomotive cranes loaded this material into rail cars; these were moved by a switch engine to unloading hoppers. At the time, this seemed the best method of handling the raw materials. Then company management saw what Michigan Tractor Shovels could do! Result?

#### Two Michigans replace two locomotive cranes

Two of the old locomotive cranes were retired, along with most of the hopper cars. Two Michigan Model 175A Tractor Shovels now do the entire job . . . moving several million pounds of raw materials per month

... saving approximately \$5,000 per month! And that's not all ...

# Weather no longer slows production

The old method of plant feeding could usually be done only in warm weather. Raw materials often froze in the hopper cars, simply wouldn't unload. Now, with Michigans, feeding is fast and dependable, no matter what the weather. Despite haul distances up to ½ mile, one Michigan outworks two railroad cranes and the large labor crew formerly used. In addition . . .

# Michigans permit new sand pit operation

Pacific Northwest Alloys used to buy sand, have it shipped in and stockpiled. Now their Michigan Tractor Shovels have made it feasible to open a small sand pit right on company property. One of the versatile 2¾ yard Michi-

gans digs the plant's daily requirements (about five loads) and delivers it to the unloading hoppers. It's a one-mile trip, but Michigan's excellent speed makes a dump-truck and driver unnecessary—it's actually less costly to let the Michigan do the whole job!

# Plant manager reports low maintenance costs

"We use the Michigans two shifts per day, seven days a week on all kinds of jobs," reports Ralph E. Ebersole, Plant Manager of Pacific Northwest Alloys, Inc. "They handle material varying from metallurgical coke (weighing 30 lbs per cubic foot) to dense chromite ore (weighing over 200 lbs per cubic foot)—yet maintenance costs have been very minor. Savings on both maintenance and labor are more than paying for the Michigans—and we have absolute assurance of uninterrupted production, regardless of weather!"

Michigan is a registered trademark of

CLARK EQUIPMENT COMPANY



Construction Machinery Division
2493 Pipestone Road, Benton Harbor, Michigan
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# MINING WORLD NEWSLETTER

San Francisco, California February 1958

Attempts to revive the copper market are continuing.

A price reduction by the nation's three largest copper producers is a recent effort to stimulate demand.

New uses for the metal are being studied by copper development associations and industry-sponsored research programs.

A "realistic" copper peril point will be sought in Congress with the strong backing of Arizona's Governor and its Copper Tariff Board.

World-wide overproduction is generally accepted as the reason for the current market World mine output of copper set a new all-time high in 1956 with 3,750,000 short tons - 10 percent greater than in 1955. All of the principal copper-producing countries showed gains. In 1957, copper production held up surprisingly well despite drastic price cuts.

Production cutbacks obviously are a partial solution to the present situation. United States mines reduced output from 1,106,000 short tons in 1956 to about 1,020,000 in 1957. Major reductions came from Phelps Dodge and Anaconda properties.

Now Kennecott has announced a 12 percent cut from its mines in 1958.

Chile, the world's second largest producer, has recommended a 10 percent reduction in output from the three large United States-owned mines there, based on their 1956 output which was 487,300 short tons. Production from these three mines in 1957 was

478,000 short tons.

Northern Rhodesia, third highest Free World producer, continues to increase its output despite warnings from such eminent authorities as Sir Ronald Prain, chairman of the Rhodesian Selection Trust Group, on the dangers of overproduction. Output in 1956 was 445,466 short tons; estimated output in 1957 is about the same. So far there have been no announced reductions for the Rhodesian mines.

Copper purchases are provided for in President Eisenhower's budget for fiscal '59. \$272,000,000 is expected to be spent for aluminum, copper, and titanium tendered under floor price purchase contracts negotiated during the Korean War to encourage expansion of output for defense. \$370,000,000 has been spent in the present fiscal 1958 period because of the "softening" of commercial markets, as compared with only \$130,000,000 in 1957. Deliveries are expected to taper off in fiscal 1959 as contracts expire.

Tungsten, asbestos, fluorspar, and columbium-tantalum received no purchase recommendations in this new budget. The program is to terminate on December 31, 1958, unless the authorized quantities are acquired sooner. The Interior Department spent \$17,900,000 on this program in 1957, \$9,400,000 in 1958, and this will drop to \$412,000

in fiscal 1959.

Spending for the strategic stockpile will drop to \$150,000,000 from the \$195,000,000 in the current period. The G.S.A. estimates it will have completed priority objectives for 59 of its 76 essential materials by the end of fiscal 1959. The agency seeks

\$70,000,000 of new spending authority in 1959; it got none this year.

Biggest increase in new funds is for raw materials for atomic energy and special nuclear materials procurement is a result of the large increase in availability of uranium concentrates. Costs for these will rise to nearly \$1,300,000, an increase of \$86,500,000. Substantial additional amounts of uranium concentrates are to be purchased from producers in the United States and Canada.

# **GARDNER-DENVER DRILL STEEL**

Cuts drilling costs...reduces steel breakage



## Made like tough rock drill parts

Gardner-Denver sectional drill steel is carburized to produce the same hard case, soft core structure that produces superior rock drill parts. Shot-peening increases fatigue resistance.

High-tensile surface strength resists abrasion, corrosion, nicking and down-the-hole gaff.

Tough, soft core provides compressive strength to withstand shock loads without breaking.

### Made from quality steel

Gardner-Denver uses special alloy steels to insure uniform hardening and longer service life.

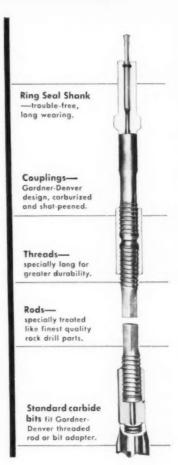
## Threads and couplings designed for the job

The extra long threads and couplings of Gardner-Denver design provide greater strength and durability. Couplings are also carburized to provide a hard surface on the threads and a tough core.

### Proved on the job

One user drilling hard rhyolite reports steel breakage reduced by 45% after changing over to Gardner-Denver drill steel.

Drill steel represents a large percentage of drilling costs. Gardner-Denver drill steel costs less to use. Write for information.



Gardner-Denver Sectional Drill Rod Specifications									
	CL5-200 Series	CL5-400 Series	CL5-600 Series	CL5-700 Series	CL5-1000 Series				
Thread Size	11/16"	1 1/4"	1 1/2"	1 3/4"	2 1/2"				
Recommended Drill Size	3" and smaller	4" and smaller	4" and 4 ½"	4" and 4 ½"	5 1/2"				
Recommended Bit Size	1 %" to 1 %"	2" to 2 1/4"	2 1/4" to 2 1/4"	3" to 4"	4", 4 ½" and 5"				
Rod Sizes	%" Hex.	1" Hex.	1 ¼" Hex.	1 ¼" and 1 ½" Hex.	1 %" Hex.				
Rod Lengths	2' to 20'	2' to 20'	2' to 20'	2' to 20'	4' to 20'				
Coupling Diameter	17/16"	1 3/4"	2 1/6"	2 1/2"	3 3/8"				
Ring Seal Shank	1" Hex. Collared 1 1/4" Rd. Lugged	1 1/4" Rd. Lugged 1 1/2" Rd. Lugged	1 1/4" Rd. Lugged 1 1/2" Rd. Lugged	1 ½" Round	2 1/2" Round				



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IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

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Gardner-Denver Company, Quincy, Illinois

Export Division, 233 Broadway, New York 7, New York

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## Congressman Mills of Arkansas Holds Strategic Spot For Mining

Lead-zinc producers have been marking time anxiously while waiting for the United States Tariff Commission to deliver its recommendations. The feeling is strong that the commission will recommend the maximum tariffs allowable under the law, but will not recommend quotas. If this is the case it probably means that an attempt will be made to push legislation through the House Ways and Means Committee for additional relief.

Because of the death of Committee Chairman Jere Cooper on December 18, Representative Wilbur Mills of Arkansas now heads this powerful committee, and there is considerable speculation as to what his attitude will be. As is well known, Mills has always pressed for legislation to aid the manganese industry and is an expert on internal taxation, but which way he will incline on tariffs seems to be somewhat in question.

#### • Canadian Announcement Revives Mills Plan

The recent announcement that the Canadian government would contribute to the Howe Sound Company to keep the Britannia mine open shows, once again, the liberal attitude of the Canadians toward mining, and provides a vivid contrast to the attitude in the United States.

According to Justice Minister Fulton, the Dominion and British Columbia governments will contribute \$20,000 a month for the next six months to assist in keeping the Britannia mine open.

The Canadian action also calls to mind the Mills plan-a sort of soil bank plan for mines which has been advocated occasionally. The main idea of the plan would apply when the Administration does not wish to maintain domestic production during peacetimes (by use of sufficient tariffs, quotas, and/or subsidies), yet might desperately need that production in an emergency. In that case, the mines taken out of production would be put in standby condition, instead of being permitted to deteriorate, and the maintenance and pumping costs paid by the government. Should the price advance to a profitable point the owners could reopen the property; should the government need the metal during an emergency it would be available. When asked how the stockholders would like such a plan, one official commented, "Wouldn't it be better than losing the mine?"

## • Restrictions Eased in Mineral Barter Program

The Department of Agriculture, with considerable fanfare, announced that steps had been taken to ease the rules which govern the crops-for-minerals barter program. For all practical purposes, this program has been at a standstill since last May when the new regulations were issued.

The most important change, it was explained, relieves barter contractors of the obligation to say in advance where the crops are going and where the minerals are coming from. Instead, they will be permitted to deal with any nation which the United States has deemed unable to pay for the surplus crops in dollars.

### • U. S. Tariff Policy Criticized

The charge that existing United States trade policy is based on diplomatic considerations and ignores the welfare of domestic industry was contained in a statement issued recently by Representative Daniel A. Reed of New York, ranking Republican on the House Ways and Means Committee. "Our industry," he said, "should not be required to survive in the United States by sufferance of the American State Department."

Reed added: "We should refrain from making tariff concessions until there is valid economic justification and reasons for concession. We must bring to a halt the prevailing practice of legislative amendment by federal bureaus and return to Congress the primary responsibility for the establishment and conduct of our tariff policy. In my judgment, existing dissatisfaction with our present trade policy can only be alleviated if we return the tariff issue to a determination according to economic and national security considerations."

### • Treasury Silver Sales Opposed

"Prudent fiscal management of the public fund would indicate that Treasury sales of silver be discontinued in order to conserve silver for Treasury's own needs," stated a memorandum submitted recently to the Secretary of the Treasury by western silver producers. They are urging the U. S. Treasury to discontinue sales of silver at less than the statutory (coinage) price of \$1.29 an ounce.

The memorandum prepared by Elgin Groseclose and submitted to Secretary Anderson states that "the silver producing industry is being adversely affected by the heavy volume of Treasury sales of silver. Such sales have increased tremendously within the past two years, and because they are effectively in competition in the domestic market with newly mined silver, have a depressant effect upon the silver producing industry."

Statistical tables accompanying the report showed that while Treasury sales of silver during the fiscal years 1947 through 1955 averaged less than 232,500 ounces a year, such sales in 1956 jumped to 10,320,051 ounces, and in 1957 amounted to nearly 7,500,000 ounces.

The government was reminded that the need for silver for subsidiary coinage (fractional dollars) is currently taking more silver than comes into the fund from regular sources of supply, and that the disposable silver in the Treasury—"free silver"—stood at less than 10,000,000 ounces at the close of the 1957 fiscal year. "The effect of continued heavy Treasury sales to industry and the arts, added to coinage requirements, will soon exhaust the reserves," the report concluded, thus forcing the Treasury "to go into the market for the added quantities needed, with the probable consequence of higher costs to the Treasury."



# "IN CASE OF EMERGENCY"

Mine emergencies happen without warning . . . and when they do happen, equipment that carries the "in case of emergency" label suddenly becomes vital to fire fighting and rescue efforts. Breathing protection devices are a major part of emergency mine equipment.

Below is a check list of this equipment offered by MSA. If you would like to make sure your emergency program is up-to-date, why not have our representative check your requirements and suggest a regular inspection and maintenance schedule.



#### M-S-A McCAA® Oxygen Breathing Apparatus—

gives complete breathing protection in any unbreathable atmosphere for a minimum of two hours. Used under the hardest physical conditions... in fighting and sealing fires, re-establishing ventilation, and rescue operations. U. S. Bureau of Mines approved.



#### M-S-A Chemox®-

allows complete breathing protection in any gaseous or oxygen deficient area for a minimum of 45 minutes. Generates its own oxygen supply from replaceable canister. Weighs only 13½ lbs. U. S. Bureau of Mines approved.



#### M-S-A All-Service Mask®-

assures safe, comfortable breathing protection against smoke and toxic gases including carbon monoxide—singly—or in combination where there is sufficient oxygen to sustain life, U. S. Bureau of Mines approved.



#### M-S-A Self-Rescuer®-

a miniature mask for use in deadly carbon monoxide following fire or explosion. Gives the miner precious minutes of emergency breathing protection. Unit is compact, lightweight; may be stored in quantity underground or carried individually. U. S. Bureau of Mines approved.



#### M-S-A Air and O2 Mask-

designed for 30 minutes maximum breathing protection in any atmosphere—supplies air or oxygen in exact accordance with breathing requirements. Flow ceases during exhalation for added economy. Comfortable to wear and easy to use.



#### M-S-A Pneolator®-

provides automatic artificial respiration that assures maximum chances of recovery for victims of poisonous gases, electrical shock, heart attacks, or other causes of asphyxia. Housed in compact, lightweight glass fiber case.



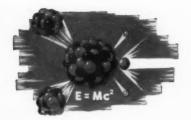
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Toronto, Montreal, Calgary, Edmonton, Winnipeg, Vancouver, Sydney, N.S.



# FISSION FACTS

Monthly Roundup of Mining News In the Atomic Energy Field

## Domestic Uranium Ore Reserves Jump in Last Few Years Far Ahead of Milling Now and Projected

One of the most detailed and informative reports on the domestic uranium industry was presented by Elton A. Youngberg, assistant manager for operations, Grand Junction Office of the United States Atomic Energy Commission at the recent Uranium Symposium of the United States Chamber of Commerce and the Uranium Institute of America.

Highlight of the report was the graph that is reproduced here. Mr. Youngberg's

comments about the graph were these.

"1. The rate of development of new reserves has increased rapidly during the past 2.5 years. In the first quarter of this fiscal year, new reserves were being added at a rate which would support a concentrate production rate about five times the current rate and about 2.5 times that required to meet present contracted capacity. During the period from July 1, 1955 to date, as shown on the graph, the rate of addition of reserves has been about 10 times current mill requirements and five times contracted capacity.

2. Because of the rapid growth of reserves, the production potential of the uranium industry may now equal or exceed foreseeable firm requirements. This has necessitated statements in regard to future contracting policies made by Jesse C. Johnson so that industry could intelligently plan future exploration, mining, and milling programs. (See Mining World, December 1957, page 75.)

"3. The aggressive past contracting policies of the Commission for new mill capacities have followed closely the ore production capabilities of the industry. Recently, statements that contracts for additional production will be limited to the approximate level of current commitments are indicated on the graph by the leveling off in 1959.

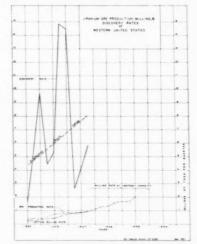
"4. Another significant production re-

"4. Another significant production readjustment problem is shown by the area between the ore production curve and the ore fed to process curve, which indicates the ores bought under the Government ore buying program. This program has served its purposes and is no longer needed, Government stockpiles now represent some 2,000,000 tons, for which the Commission has spent \$39,900,000.

"The key to future production capabilities is the rate at which ores can be developed. Experience in recent years has been that industry can develop ores for mining at a much faster rate than needed for the present indicated government requirements. A better understanding of uranium geology and improved drilling technology has made this possible. Because of the shallow depths of many of the large bedded deposits, it also has been possible to obtain ore production quickly and at a high rate."

also has been possible to obtain ore production quickly and at a high rate."

Domestic ore reserves (Gran's, Gas Hills-Crooks Gap, Big Indian, Uravan, southeast Utah, and others) total 75,800,-



000 tons containing 205,000 tons of  $U_2O_8$ . Canadian reserves are 320,000,000 and 380,000 tons, respectively, and South African 1,100,000,000 and 370,000.

The importance of the uranium industry was clearly outlined by the 727 uranium mine operators in 1957. While it is true that 10.2 percent of mines shipped 91.2 percent of tonnage the small miner is important because 172 operators shipped more than 1,000 tons and only six over 100,000.

The economic picture of uranium mining is summarized in the accompanying table. This table also includes the average milling costs per pound of  $U_2O_3$  recovered from ores mined in the four major districts.

The milling costs were announced at the Symposium by A. H. Ross, A. H. Ross and Associates, Toronto, Canada; and Ralph Toerper, mill superintendent, Climax Uranium Company, Grand Junction, Colorado. Treatment costs per ton of ore not shown in table were given as \$2.00 per ton in South Africa, \$6.00 to \$9.50 in Canada, and \$10.00 to \$17.00 per ton in the United States.

What do all these figures mean? A close race after 1962 to see which country can achieve lowest costs, Both Canada and South Africa have low-grade ores, but tonnages are large and many south African costs are chargeable against gold production. It will take good mines and good management for United States producers to compete in an open commercial market.

#### United Uranium Receives Contract for U.O. Sales

United Uranium N. L. has completed negotiations with the United Kingdom Atomic Authority for the purchase of uranium concentrates from the South Alligator River area, and construction of the company's new mill is underway (see Mining World, December, 1957, page 43).

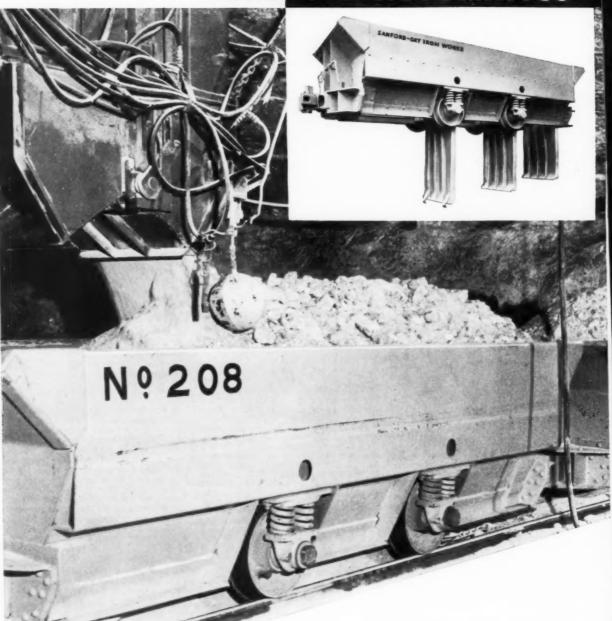
A topographical survey of the mill site is in progress at El Sherana and ore excavating equipment has already arrived at the mine. During the next dry season. ore will be stockpiled from the El Sherana and ore excavating equipment has already arrived at the mine. During the next dry season, ore will be stockpiled from the El Sherana, ready for milling operations which are scheduled to begin at the end of 1958. Water for ore treatments will be supplied from a 100,000-gallon-capacity reservoir to be built in Stag Creek Gorge, two miles from the mill.

Typical Median Mining Costs Per Ton in Largest United States Mining Districts, Costs Per Pound of U.O. Recovered In Same Districts, and Average Milling Costs Per Ton Based on Indicated Grade<sup>1,2</sup>

	Uravan Mineral Belt	White Canyon Monument Valley	Big Indian Wash	Ambrosia Lake (Grants)	5-1	Open Pit Stripping Ratio 8-1	os 12-1
Exploration	\$ 2.00	\$ 2.00	\$ 1.00	\$ 0.50	\$0.30	\$0.50	\$0.70
Development	3.00	1.50	1.00	1.50	2.00	3.20	4.80
Depreciation (Plant & Equip.)	2.00	2.00	1.00	1.00	0.50	0.50	0.50
Direct mining	11.00	8.50	6.00	7.50	1.25	1.25	1.2
Indirect mining	2.00	2.00	2.00	1.50	0.75	0.75	0.7
Total	\$20.00	\$16.00	\$11.00	\$12.00	\$4.80	\$6.30	\$8.0
Recoverable pounds U <sub>3</sub> O <sub>8</sub> per ton	5.3	5.4	7.3	4.4			
Mining costs per pound of U <sub>2</sub> O <sub>8</sub>	\$ 3.77	\$ 2.96	\$ 1.51	\$ 2.73			
Milling cost per pound of U <sub>2</sub> O <sub>8</sub>	\$ 2.70	\$ 2.72	\$ 2.95	\$ 2.55			

1. E. A. Youngberg, Assistant Manager for Operations, Grand Junction Operations Office, United States Atomic Energy Commission, Uranium Institute of America speech, December 16, 1957. 2. A. H. Ross and Ralph Tocepter, "Economics of Uranium Ore Processing" Uranium Institute of America speech, December 16.

# These S-D AUTOMATICS





Knoxville, Tennessee

"SUPER MARKET FOR MINE CARS" — all types \* PRE-CISION WHEELS \* "BROWNIE" HOISTS, CAR RETARDERS, SPOTTERS, PUMPS AND OIL SPRAY SYSTEMS \* GISMO SELF-LOADING TRANSPORT that loads (mucks) in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

# have been in service at U.S. Potash 3 years...working 363 days per year, two shifts per day on a seven-mile run!



Another example of efficient main-line haulage with S-D "Automatic" Bottom Dumping Mine Cars!

"Because of their low center of gravity and balanced rugged construction, they hold the track exceptionally well at speeds up to 30-miles-per-hour," reports Mr. Earl H. Miller, resident manager of the Carlsbad, N. M., mining operation of United States Potash Company, Division of United States Borax & Chemical Corporation.

"Also," Mr. Miller continues, "the door operation is very good, allowing the cars to do a good job of self-cleaning." How does the maintenance costs of these cars compare with conventional type ore cars? "We have had very low maintenance costs on the S-D 'Automatics' compared to others we are using."

Note in pictures above and on page at left that mining management at U. S. Potash have further mechanized their main-line haulage with an automatic loading station. We are understandably proud that S-D "Automatics" were chosen for this U. S. Potash operation that incorporates the latest developments in modern simplicity and efficiency. In addition to this installation, S-D "Automatics," like the car illustrated at right, are hauling hard rock in several western mines at tremendous savings! Write us today for complete information. Sanford-Day Iron Works, Inc., Knoxville, Tennessee





This Bucyrus-Erie walking dragline is stripping rock overburden in a West Virginia coal mine.

# In the Low Cost Production Race a WALKER Sets the Pace

# . . . Bucyrus-Erie Walking Dragline

The economical operation, big production and year-after-year dependability of Bucyrus-Erie walking draglines make them pace setters wherever big volumes of overburden must be moved at lowest possible cost. You'll find them in coal mines from Missouri to Morocco . . . from Pennsylvania to the Philippines.

Each member of this famous line, from 4 to 34 cubic yards, brings you the same low cost and dependable performance that has been associated with Bucyrus-Erie walking

draglines for years. Heavy-duty construction from base to boom point cuts maintenance costs, adds years to machine life. Each machine has proved Bucyrus-Erie design superiority—a front end that's very strong yet light in weight—exclusive walking action with design simplicity that minimizes maintenance, gives you cushion-smooth moveups. These and many other features combine to give you a high-volume, low-cost-yardage excavator that sets the pace wherever it works.

A Familiar Sign . . .



. . at Scenes of Progress

BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

# Right off the Wire

A double submarine cable, 2400 miles long, gives direct telephone service between California and Honolulu. It reaches ocean depths up to  $3\frac{1}{2}$  miles. Simplex manufactured 60% of the cable.

83

Dissimilar, non-ferrous metals, including aluminum, copper, magnesium, titanium, brass, zinc, silver and gold can now be bonded by a new ion-exchange process.

8

Doppler radar, installed in aircraft, is being tested by commercial transport planes. If satisfactory, it is expected to have farreaching effects on civilian navigation.

8

By using a 3800-gallon bag of rubber-coated rayon to contain liquids, a truck trailer can now serve a double purpose. Various linings make the bags suitable for corrosive or edible liquids. It is planned to make them in larger sizes for barges or storage.

8

A new pencil feeds lead automatically to maintain the correct writing length.

80

A new low-temperature laboratory is equipped to produce fifty quarts an hour of liquid hydrogen at  $-423^{\circ}F$ . and eight quarts an hour of liquid helium at  $-453^{\circ}F$ .

8

A color-video tape recorderplayer has been announced.

8

A new off-shore drilling platform is able to operate in 600 feet of water. Present equipment is limited to about 100 feet.

8

A model of an ion-propelled rocket has been exhibited. Theoretically it should have an efficiency of 90 per cent and a speed of 25,000 miles per hour. Power would be derived from a nuclear reactor.

A mechanical construction kit for adult tinkerers contains 5,000 parts. It is claimed that a working model of almost any machine can be built with it.

89

One of the new European cars has three headlights mounted side-by-side behind a screen of curved glass. The middle lamp is pivoted and turns with the wheels.

6

A single drop of a new adhesive, used to join two pieces of metal, has supported a load of 5,000 pounds.

8

Paint that changes color at high temperatures is being used in oil refineries as a safety measure.

Ed

Man-made lightning, to test insulated cable, is produced by the new 1,400,000-volt impulse generator in the Simplex research laboratories.

83

A new fuel for jet and ramjet engines has a boron-hydrogen base and should increase the range of aircraft using it by forty per cent.

80

A new kind of "electric eye" uses radiation from a small amount of strontium-90 instead of an electric light. It requires no power supply and is not subject to interference from dust or smoke.

89

A twenty-five acre business center, being built in Venezuela, is in the form of a helicoid. It will be 365 feet high and access will be by a spiral ramp. At the top will be a 170-foot aluminum dome housing an exhibition hall and television station.

8

A generator has been designed that produces electric power directly from the chemical reaction of hydrogen and oxygen. Since 1950, over 4000 miles of cable protected by Simplex C-L-X type sheaths have been put in service. No sheath failures have been reported.

छ

A new eighteen-pound refrigerator will operate for fifty hours on a bottle of propane gas, or indefinitely on household current.

83

The problem of shipping giant transformers by rail has been minimized by making the transformer the central part of the car. Both height and weight are thereby reduced.

63



# Of current interest:

Recently, Simplex had the pleasure of publishing a new

publishing a new book called TRANSOCEONICS, depicting the historical development of underseas telephone cables. If you have read TRANSOCEONICS, you will recall the magnitude of some of the projects undertaken by Simplex.

We hope you will also remember that Simplex manufactures cable for nearly every electrical need, regardless of project size. All the proficiency acquired during our seventy years of leadership in cable manufacturing and research is at your disposal. Call or write to:

#### SIMPLEX WIRE & CABLE CO.

Cambridge, Massachusetts and Newington, New Hampshire

Simplex

Highest quality cables for: Mining Power & Lighting • Construction Transportation • Communications Signalling

<sup>&</sup>quot;the American manufacturers of transoceanic telephone cables"

# you DIG more



# with BREAKOUT action

... and 40° bucket tip-back at ground level, both of which are productive features EXCLU-SIVE with "PAYLOADER" tractor-shovels. They can not be found on any other rubber-tired loader.

To the user they mean that loads can be obtained easier and faster with less strain on the machine and bigger loads can be RETAINED in the bucket with the 40° tip-back AT GROUND LEVEL.

The FIRST four-wheel-drive tractor-shovels were introduced by The Frank G. Hough Company just ten years ago and many of them are still in daily use. Neither they, nor any of the numerous copies being offered are as productive as these new "PAYLOADER" models.

Every "PAYLOADER" distributor not only invites comparison but will be glad to PROVE in ACTUAL DEMONSTRATION all of the points of "PAYLOADER" superiority.



PAYLOADE R

THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.



11-B-1a

# you CARRY more



# with CUSHIONED loads

. . . using hydraulic load-shock absorber as standard equipment on all four-wheel-drive "PAYLOADER" models, another HOUGH EX-

It doesn't matter what kind of an extra big load an operator was able to get to begin with if most of it is lost in SPILLAGE while traveling.

The "PAYLOADER" load-shock absorber does not completely eliminate spilling if you are operating over exceptionally rough surfaces . . . but it does minimize the loss and enable you to RETAIN more.

This is just one more reason why these new "PAYLOADER" tractor-shovels are more productive and why the combination of all the features which only Hough-designed units offer the user make "PAYLOADER" a better buy than any other equipment.

If you are not familiar with these new models your "PAYLOADER" distributor will be glad to demonstrate them to you.



PAYLOADER





# you DELIVER more



# with NO STOP for shifts

... which the "complete" power-shift transmission of these "PAYLOADER" units provides by saving time and effort.

There is no need to bring HOUGH tractorshovels to a stop for a "range" shift. All shifts in both forward and reverse can be made "on the go".

When you travel over muddy or slippery terrain, "power-transfer" differentials automatically transfer more power to the wheels with the best footing. This is another STANDARD on all four-wheel-drive "PAYLOADER" tractor-shovels.

Therefore, if you GET more at the start, if you SPILL less during travel, if you can travel faster with NO STOPS for shifting and better traction . . . . you are going to be able to **deliver** MORE . . . and, after all, that's what counts.

Only "PAYLOADER" tractor-shovels have all of these PRODUCTIVE features which spell more PROFITABLE operations for the user.



# you GET more



# with GREATER choice

. . . of any and all kinds of financing.

What best fits your needs?

Do you want to purchase on a **time payment** plan? Your "PAYLOADER" distributor can offer you such a plan tailored to various periods to suit your needs.

Do you want a **leasing plan\*** with an **option** to **purchase?** He has a number of these which can be adapted to fit your requirements and preferences.

Do you want a straight **leasing plan\*** without a purchase option? He can provide "PAY-LOADER" equipment for your operations on a straight leasing plan.\*

Your distributor of "PAYLOADER" machines now has at his disposal the broadest and most complete set of financing plans and arrangements being offered.

He will be glad to discuss your needs for the finest equipment and offer you the greatest choice of terms. He will consider trade-ins.

He'll even take cash!

Consult him at once.

\*(available in the continental U.S.A.)





"Not merely to sell; but to serve...not only to make good steel products; but to make them still better...not only to fulfill today's requirements; but to anticipate tomorrow's—these are the principles that constantly guide CF&I."





# We've taken our own advice

When any business is "soft", management often uses this period to clean house. All operating methods are examined carefully with an eye toward increasing efficiency by revising or eliminating those practices that hamper productivity—practices that could not be corrected during peak periods.

In the past, there have been times when the demand for CF&I Grinding Balls has exceeded our capacity, and you have had to wait for deliveries. More recently, demand has been off somewhat, and we have utilized this period to improve our own production efficiency, and new equipment has been added to increase our volume. Now we are in a position, when the demand again picks up, to offer you greater production and quicker deliveries from our enlarged stocks of grinding balls. Thus, we have "anticipated tomorrow's requirements"—we have taken our own advice.

We feel sure that most grinding mill operators follow these procedures—that they do make a drive toward increased efficiency during slack periods, so that they will be all the more prepared for periods of intensive output. To help you do

this, CF&I has instituted this two-pronged service program:

- Engineering Service . . . CF&I's Mining Products Engineers are ready to analyze your grinding mill problems; make recommendations on how you can improve your operations.
- Technical Information... CF&I is currently preparing a series of advertisements containing technical information on ways to improve grinding mill operations.

Take advantage of our Engineering Service and look for the ad series in this publication . . . they'll be appearing regularly during 1958 and reprints will be available. The nearest CF&I sales office will be glad to service your needs,

#### Other CF&I Steel Products for the Mining Industry

CF&I Grinding Rods • CF&I Rock Bolts • Wickwire Rope
CF&I Mine Rails and Accessories • CF&I Industrial Screens
Realock Fence and Fabric • Grader Blades and other
Cutting Edges

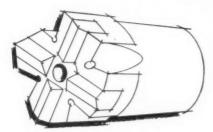


# FORGED STEEL GRINDING BALLS THE COLORADO FUEL AND IRON CORPORATION

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5662

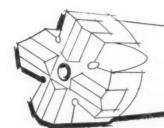
# NOW!



# REMOVABILITY (0)



# AND



# ONE-PIECE STRENGTH

# IN AN AIR-LEG BIT!

AIR-LEG drillers, now you can have your cake and eat it, too. The new Timken tapered socket bit is removable—yet gives you the strength of one-piece steels. The secret is the taper. It gives you all the advantages of removability with a strong, secure union.

Here are a few of the plusses you get with the Timken tapered socket but can't get with intraset steels because they're not removable.

 You don't have to throw away the drill steel just because the carbides wear out. You do with an intraset steel.

2. You carry just a pocketfull of bits into the mine. Try putting an intraset steel in your pocket.

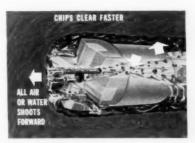
3. You can quickly change bit gage sizes using the same steel. With an intraset steel, you have to change a whole steel.

4. You don't have to lug the whole steel back to the shop to resharpen the cutting edges. You do with a 4-point intraset steel.

5. You get four carbide cutting edges. You get only two with a chisel intraset steel.

And you get further economies because the Timken tapered bit clears chips faster. The picture at right shows you how. New special-analysis carbide inserts give superior wear-resistance with added shock-resistance. And they can be reconditioned many times.

For removability and strength, use the air-leg bit of the future. Write for our free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

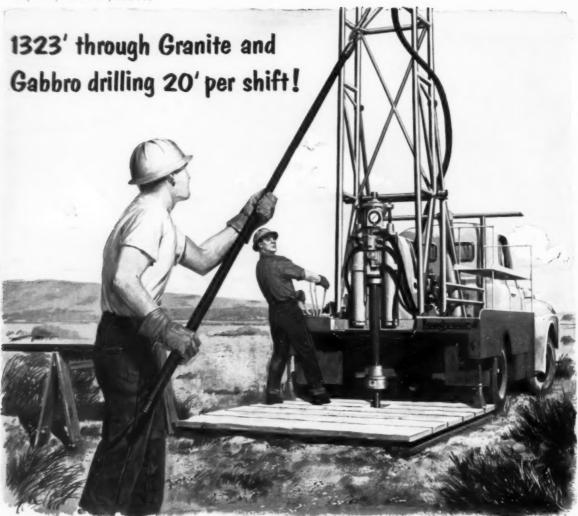


CHIPS CLEAR FASTER because 1) new five front holes shoot water or air directly against the rock face and 2) new deeper, wider wing clearance lets chips wash back faster.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

AVAILABLE NOW! THE AIR-LEG BIT OF THE FUTURE



# Typical of Good Results With Longyear "W" Series Rods

Longyear "W" Series Rods head off trouble drillers encounter using ordinary rods. Here are four reasons why drilling costs are lower with "W" Series Rods.

- 1 Drill cuttings are discharged at the surface faster because the smaller space between the rod and the hole wall increases the velocity of the discharge water.
- 2 "W" Rods are stiffer. Increased diameter makes the drill string less flexible, more stable. Closer fit in the hole minimizes vibra-

tion, reducing gear and bearing wear in the drill.

- 3 Coupling openings are 22% to 88% larger than in E, A, B, and N couplings. Thus, with proper pumping facilities, an adequate water supply is more easily pumped across the face of the bit, minimizing the chances of burning due to lack of water.
- 4 Improved thread design makes coupling and uncoupling easier and faster.

Longyear "W" series rods are

matched in advantages and performance by other components of Longyear Coordinated Systems for diamond drilling, including the finest drills, pumping units, diamond bits, and core barrels.

For complete information on Longyear "W" Series Rods, write for Longyear World No. 3, E. J. Longyear Company, Minneapolis 2, Minnesota

#### E. J. LONGYEAR COMPANY

76 South 8th Street • Minneapolis 2, Minnesota CANADIAN LONGYEAR, LTD., NORTH BAY, ONT... LONGYEAR, N.V., THE HAGUE, HOLLAND LONGYEAR ET CIE., PARIS, FRANCE



THE WORLD IS OUR WORKSHOP

Diamond Core Drill Manufacturers • Core Drilling Contractors

Mining Engineering and Geological Consultants

# ENGINEER'S FIELD REPORT

PRODUCT

RPM DELO OIL

PORTER BROTHERS CORP.

FIRM Bear Valley, Idaho

# Operates 7,000 hours without measurable wear



Lubricated with RPM DELO Oil, this 650-hp Ingersoll-Rand diesel is still in nearly new condition after three years' service. "We found no carbon sludge or lacquer when we tore it down last winter," says Power Plant Foreman Bill Niece (above). "And there was no measurable wear on rings, liners or bearings, though it had run more than 7,000 hours!" Engine is in power plant of Porter Brothers Corp. Firm dredges for strategic minerals under government contract.



**Trucks** hauling firm's ore work 'round the clock,  $9\frac{1}{2}$  months a year. Despite the tough punishment of carrying heavy loads over unpaved mountain roads, RPM DELO Oil keeps engines running smoothly, and eliminates excessive wear.





Giant dredge (left) processes nearly 6,000 yards of gravel every 24 hours. "Both this and our smaller dredge depend upon our dieselgenerators for power," explains Superintendent Clay La Fon (right).

"That's why we do everything possible to keep them running properly...and that includes using RPM DELO Oil. We've had excellent results with it in all our equipment...in our power plant, in our trucks, and in the tractors that level our tailings and restore the areas we've worked."

STANDARD OIL COMPANY OF CALIFORNIA 225 Bush Street • San Francisco 20, California

# Why RPM DELO Oils reduce wear—prolong engine life

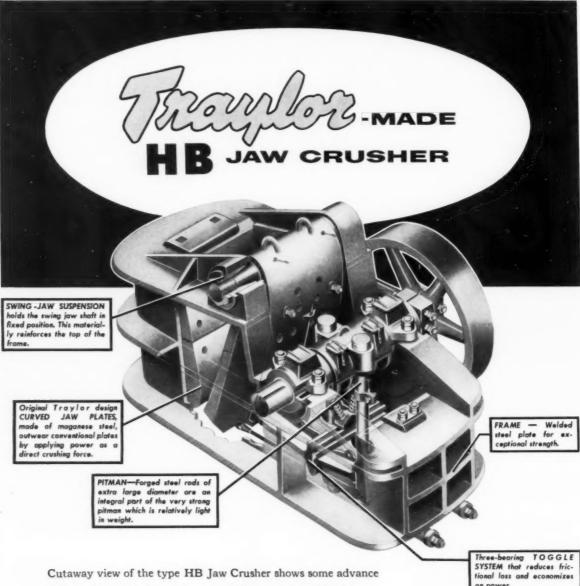
- Oil stays on engine parts—hot or cold, running or idle
- Anti-oxidant resists lacquer formation
- Detergent keeps parts clean
- Special compounds prevent corrosion of bearing metals
- Inhibitor resists crankcase foaming



For More Information about this or other petroleum products or the name of your nearest distributor, write or call any of the companies listed below.



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design characteristics. For over half a century, Traylor engineers have improved and perfected the design of crushing machinery. Call on Traylor engineers to help you solve your crushing problems. Write for bulletin No. 5105 today!

on power.

## TRAYLOR ENGINEERING & MFG. CO., 1012 MILL ST., ALLENTOWN, PA.

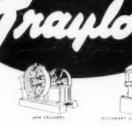
Sales Offices: New York — Chicago — San Francisco Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.



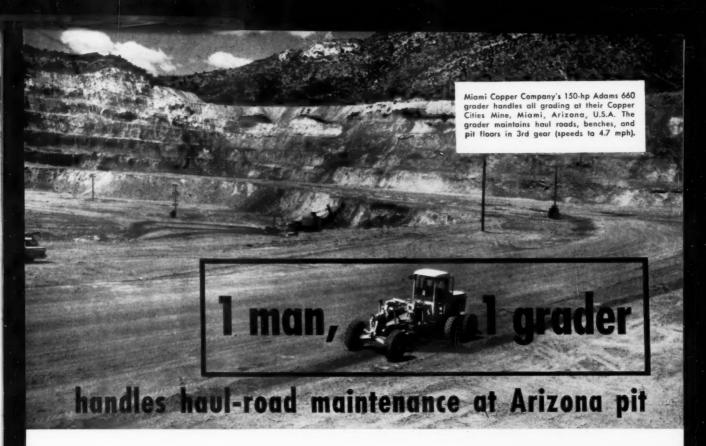












Miami Copper Company mines 24,000 tons of rock and ore per day at its Copper Cities Division pit, Miami, Arizona, U.S.A. This material is transported by nineteen 30 to 40-ton trucks. An average of 8 trucks per shift travel over 3 miles of haul and access roads 24 hours a day, 7 days a week. To keep these roads, and 6 miles of outside roads, benches, and pit floors, in high-speed hauling condition, the mine relies upon one motor grader, a 150-hp Adams 660, working an eight-hour shift, 6 days a week.

#### Maintains roads in 3rd gear

With 8 forward and 4 reverse speeds standard in the Adams grader, the operator always has the best powerspeed ratio to handle any job fast and accurately. For working in close quarters, and where extra power is needed the grader may be equipped with 3 optional extra-slow creeper gears. On haul-road maintenance, the Adams 660 grader works at speeds to 4.7 mph, in 3rd gear. The machine's 26-mph travel speed proves advantageous, too, for this Adams motor grader is never more than a few minutes away from any assignment around the pit area.

#### "Handles jobs twice as fast"

Said operator T. S. Ashford, of the Miami Copper Company, "I like the power of the '660'. I can do a job twice as fast." Ashford added, "I like the controls. I can work two controls (lateral shift and circle) at the same time, with one hand!"

#### Smooth, accurate control from cab

On the Adams 660 grader (as on all Adams models), all blade-positions are power-controlled from the cab. The operator has exact control, because the blade mechanism is always firm on its sturdy, one-piece frame. In addition, the blade always

operates at constant speed, regardless of the number of controls in use.

The blade can be moved from a deep ditch-cut to a high bank-cut in less than a minute, and to other positions in even less time. The moldboard turns 360° for quick changes from forward to reverse, ditching and grading.

We shall be pleased to send you more information on Adams graders, built by LeTourneau-Westinghouse. These graders are available in 6 sizes, 60 to 190 hp. Choose between General Motors or Cummins engines on the 5 larger models. The 190-hp grader has torque-converter drive.

Adams-Trademark G-1524-MQJ-1r

Speedy 660 Adams motor grader cleans up around shovels to save wear on haulers' tires and permit faster shovel operation. At the firm's Copper Cities pits, about 24,000 tons of rock and ore are mined per day.





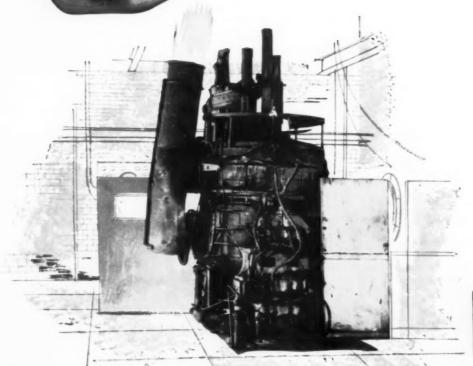
LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

# On silver and cobalt production at Deloro Smelting & Refining LECTROMELT FURNACE EQUIPMENT

Silver is first smelted from the ore with Lectromelt furnace equipment at Deloro Smelting & Refining Company, Deloro, Ontario. Metallic cobalt is produced in a blast furnace, then melted in this 800 kva Lectromelt furnace to produce cobalt shot.

For data on melting and smelting furnaces, write Lectromelt Furnace Division, McGraw-Edison Company, 324 32nd St., Pittsburgh 30, Pennsylvania.





Lectromelt

• Reg. Trademark U.S. Pat. Of

# Can ONE tractor keep up with your scattered maintenance assignments? Cleans dirt-wash on bench Cleans-up Cleans-up around shovels after blasting dandles shallow witches cars Maintains Cleans-up stockpile stripping in yard haul roads and plant yard

Lo meet increased production demands, it will be to your advantage to consider a mobile, rubber-tired tractor, one that can economically handle your additional clean-up work over larger pit areas. You can save time and money with a mobile tractor-onrubber that can speed directly to each new assignment, on or off haul roads.

LeTourneau-Westinghouse Tournatractor, with its wide, low-pressure tires that let you travel anywhere over haul roads, rocky pit floors, railroad tracks, ties, switches, and air-drill lines, has these capabilities.

#### Work-and-run mobility

Since this 17 mph tractor can travel 2 to 3 times faster than a crawler, it gives you a major speed advantage when traveling between clean-up assignments around scattered shovels. Tournatractor's speed also increases its versatility, so that it can be used as a multi-purpose tool, to economically handle many types of assignments.

You can use Tournatractor to clean around 2 or more shovels; to maintain stockpiles, level waste dumps, remove debris from railroad tracks; to clean benches, handle shallow stripping, switch cars; to pull air compressors, supply and service wagons on sleds. With this rubber-tired tractor, there are no long delays for travel, or for loading and hauling to a new location. You can even use it for maintenance and clean-up in one or more adjoining pits. This reduces costs.

Many owners report the costs of maintaining Tournatractors to be only onefourth to one-half the cost of crawler maintenance. The main reason is that you have only 4 wheels and tires to maintain and replace, instead of the more than 500 moving, wearing track parts on a crawler. Tires flex over rocky floors, do not concentrate loads that break track links. Also, this rubber-tired tractor has fewer lubrication points, reducing daily lubrication time to less than one-half that required for a crawler-tractor.

#### Ask for more information

When analyzing your equipment needs, investigate Tournatractor's exceptional mobility and its application to scattered clean-up work in your pits. Let us send you more information.

Tournatractor with Angledozer blade uses its 17 mph speed and rubber-tired mobility to handle wide variety of assignments at a large open-pit copper mine in Arizona, U.S.A.



Fast clean-up of big chunk rock around shovel is handled by Tournatractor for the Ruberoid Co., near Lowell, Vermont, U.S.A. Tractor dozes at about 8.3 mph, and reverses at 7.2 mph.



Equipped with railroad coupler, versatile Tournatractor serves as a SwitchTractor, positions rail cars when not working on dozing chores for a U.S. uranium mine. The SwitchTractor can move 5 loaded cars up a 1% grade.

SwitchTractor-Trademark; Angledozer, Tournatractor-Trademark Rea, U.S. Pat. Off. CT-1727.M-1r



LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

# "Everything But the Squeal" From a Single Source



tons of complex copper-zinc concentrates per day.

# Fluidization - key to maximum utilization in Japan

Processing copper bearing pyrrhotite ore, the Dowa Mining Company at the Okayama, Japan plant is producing . . . and all from the same raw material . . . sintered iron ore for blast furnace use, cement copper and sulphuric acid.

Of major importance in this unique installation is the Dorrco FluoSolids System, consisting of two 20 ft. dia. Reactors plus auxiliary equipment. Utilizing the proven principles of fluidization, the crushed raw ore is roasted under controlled conditions in the System providing SO2 gas for contact acid manufacture. Roaster calcine is acid leached for copper recovery and leach residue is sintered as blast furnace feed.

The Dorr-Oliver research, design and engineering staffs and our Associates in Japan, Sanki Engineering Co. Ltd., of Tokyo, have collaborated with Dowa Engineers before. At Dowa's hydro-metallurgical plant in Kosaka, Japan, Dorrco FluoSolids System is a prime factor in the world's first successful roasting of copper and zinc with electro winning of both metals. In the Okayama installation as at Kosaka, manufacture of the FluoSolids Reactors and a number of components in Japan with auxiliary equipment furnished from the U.S. proved to be most advantageous to Dowa.



One of two 20 ft. dia. FluoSolids Reactors roasting 235 metric tons per day of crushed pyrrhotite ore at Dowa's

This is but another example of how the flexibility of the Dorr-Oliver Worldwide engineering organization can work to the advantage of a client. It can work for you. detailed information on D-O equipment and services involving the sepration of finely divided solids in suspension or fluid techniques, drop a line to Dorr-Oliver Inc., Stamford, Connecticut.







Draglines of 4 and 5 cubic yard capacities load Tournapulls with wet bauxite ore. These pits, about 18.6 miles south of Paramaribo, Surinam, are owned by Billiton Bauxite Mines, of Surinam's Billiton Company.

# IN SURINAM BAUXITE MINES,

# 15 Rear-Dumps haul through .9 meters of mud, water

A fleet of 10 Model C and 5 Model B Tournapull Rear-Dumps haul ore and overburden for the Billiton Bauxite Mines in Surinam, 24 hours a day, 7 days a week, These mining installations cover 8½ square miles, and ship approximately 750,000 tons of bauxite ore every year.

#### Work 45 to 70 feet below sea level

In open pits, 45 to 70 feet below sea level, C Tournapulls are dragline-loaded with 22 tons of water-soaked bauxite ore. B Tournapulls (some equipped with sideboards and tailgates) haul loads that average 35 tons of the wet material.

Torrential rains frequently fill the bauxite pits with water. Although a battery of pumps operate to keep the pits dry, Tournapulls must sometimes work in 2.9 feet of bauxite slop. Since other equipment is unable to keep working in the flooded areas, it is impractical to use any-

thing but Tournapulls here, say company officials.

#### Travel 1.8 to 3.1 mile cycles

Cycles vary from 1.8 to 3.1 miles, depending on the area being mined. Hauls include a .6 mile climb out of the pit, up 3 to 8% grades.

On these cycles, each Tournapull delivers a load of ore in approximately 25 minutes. This average cycle time includes frequent waits at the dragline for loading.

After working all week (6 days) hauling ore to the plant, these Rear-Dumps are used on Sundays to move clay and high-grade iron ore to surface haul-roads. A rubber-tired, 210 hp Tournatractor, also manufactured by LeTourneau-Westinghouse, is used by the Billiton Company for general mine maintenance.

#### Liked "C's"; purchased "B's"

The 35-ton B Rear-Dumps were added to the equipment fleet because

Billiton Mine officials were so well satisfied with the production of the smaller 22-ton Model "C's" (which had already been used 5 years).

# "More economical than any other unit"

Phillip Begeman, the mine superintendent says, "Due to past performance of C Tournapull Rear-Dumps, and the result of a trip to the U.S.A. to check all other competitive units, I firmly believe the B Rear-Dump performs on our job much more economically than any other unit of this type now being manufactured."

When this job was visited, B Tournapulls had been used about 4,200 hours each; "C's" more than 26,000 hours per unit. It is expected that the new larger machines will double the present 750,000 tons output.

Write us if you would like more information on rugged LeTourneau-Westinghouse equipment.

Tournatractor, Tournapull—Trademark Reg. U.S. Pat. Off. CRBR-1435-M-1r



# LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

# PINE COPPER MINE **USS "T-1" Steel consistently**



# \*Feeder chute liners last 2 to 3 times longer

Hard and flinty copper ore plays hob with ordinary materials. That's why virtually all the feeder and transfer chutes in White Pine's crushing plant are now lined with USS "T-1" Steel. Quenched and tempered to 321 minimum Brinnell, USS "T-1" Steel liners, 3/8" thick, have proved far longer-lasting than materials formerly used-give from 2 to 3 times longer service. These "T-1" Steel liners are easy to fabricate, are readily flame-cut to size-a great advantage over cast, anti-abrasive materials.

Also available from United States Steel-our well-known USS High Strength Steels, for many years standards for mining and ore handling equipment.



# outperforms other materials

# Provides very high resistance to impact abrasion plus superior strength and toughness that keeps equipment in service far longer than before\*

White Pine Copper's experience with USS "T-1" Steel is typical of the improvements in service that this remarkable steel makes possible.

Wherever they have used it to replace former construction, equipment life has been materially increased. Repair and maintenance costs have been cut. Down time has been reduced. All this means important savings in time and money—savings that are far greater than the difference in initial steel cost.

USS "T-1" Steel is unique. There's never been another commercial alloy plate steel just like it. None better able to stand up to the brutal abuse inflicted on mining equipment... and as readily handled in fabrication... and so economical on the basis of performance.

# Here's why USS "T-1" Steel can help you improve your equipment

When you want strength far beyond the ordinary, you can get it with USS "T-1" Steel—for, with a minimum yield strength of 90,000 psi and a minimum tensile strength of 105,000 psi, USS "T-1" Steel is nearly three times as strong as structural carbon steel. This is far higher yield strength than has ever before been available in weldable plate steel. What's more, its strength is not lowered by welding or gas cutting.

For equipment subject to impact abrasion, USS "T-1" Steel can be obtained quenched and tempered to a minimum hardness of 321 Brinell. Even this very hard grade can be welded and flame-cut *right in the field* without preheating. That means you don't have to shut down costly, big-capacity equipment for the many hours generally required for shop repairs.

If your equipment must withstand severe impact abuse, USS "T-1" Steel insures against damage in winter weather. Whether furnished to 321 minimum Brinell or to 90 000 psi minimum yield strength, it has exceptional toughness and resistance to brittle failure, even at temperatures far below zero.

Our new catalog—USS "T-1"—is complete with technical information and offers many practical suggestions for its use that can save *you* money. For your free copy, write to United States Steel Corporation, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

UNITED STATES STEEL CORPORATION, PITTSBURGH
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



# \*Loader plates last 8 to 12 months longer

At White Pine Copper, USS "T-1" Steel, supplied to 321 minimum Brinnell, is used in the bottom and side plates of the conveyor of this loading machine. Also, in the plates on its underside along which the returning conveyor chain slides. Prime requirements here are toughness and high resistance to impact abrasion. Every one of these underground loaders has been overhauled since the mine was opened and, in every case, USS "T-1" Steel has been used to increase durability. The result-8 to 12 months more service life.

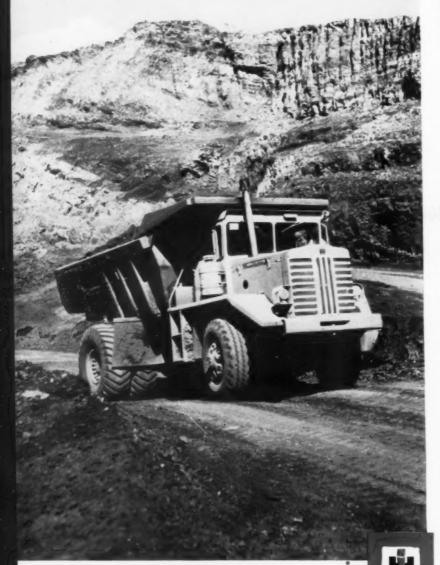




# THEIR RUGGEDNESS IN ROCK



# "95" Payhauler beats trailer units by up to 50 seconds... in 20% grade climb-outs!



# Phosphate mine superintendent reports"95" gains up to 100 cu. yd. daily!

A bonus-powered International "95" Payhauler®, in carefully timed tests, climbed the winding 20% grade, up to 50 seconds faster than competitive crawler-pushed trailer units!

The Payhauler, and the two "articulated" hauling units, bring out 18 cu. yd. loads apiece at the Simplot Corporation's phosphate rock mining operation near Blackfoot, Idaho.

Supt. Robert Bulard reports: "The Payhauler gains approximately 100 cu. yd. daily over our other 18 cu. yd. haul units. Not only does it have greater speed, 'but the Torqmatic braking gives it greater safety as well. This morning, light rain made pit roads so slippery all equipment quit except the Payhauler. It never missed a load."

Power on Payhauler rear wheels delivers top operating efficiency on steep grades or under "slick" conditions where trailer units bog down completely. Prove the fast get-away surge, the extra climbing power, and up to 25% faster haul speed of an International Payhauler. That's the exclusive result of bonus turbo-charged diesel power; road-matched and load-matched gear choice; and the power-cushioning leverage of planetary drive axles!

Try Payhauler "pick-up truck" spotting ease. Exclusive high reverse speed, "zip-around" power steering, and gradebeating power get the credit! See how 12-second dumping with double-acting hydraulic hoist speeds the cycle. See your International Construction Equipment Distributor for a Payhauler demonstration.

# International Construction Equipment

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE. Crawler and Wheel Troctors...Self-Propelled Scrapers...Crawler and Rubber-Tired Loaders...Off-Highway Haulers...Diesel and Carbureted Engines...Motor Trucks...Farm Tractors and Equipment.

#### International Harvester Co. 180 N. Michigan, Chicago 1, III.



☐ I am a contractor. ☐ Am an equipment operator (please check square that applies). Send me Payhouler Catalog (CR-603-G).

Name.					 	
Street	Address					

City\_\_\_\_\_State\_\_\_\_

# Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

February 1958

## INTERNATIONAL PANORAMA

ROSICLARE, ILLINOIS-Fluorspar mining operations have been resumed at Rosiclare Lead and Fluorspar Mining Company's properties in northern Hardin County by three independent mining operators.

HOUSTON, TEXAS-Freeport Sulphur Company will drill the southeastern section of Sulphur Exploration Company's 29,000-acre concession on the Isthmus of Tehuantepec, in southern Mexico. Freeport will build a plant and produce sulphur if commercial deposits are found.

KAMPALA, UGANDA-Kilembe Mines Ltd. is installing an additional milling unit to raise mill capacity by 500 tons of oxide ore per month. This means a 300-ton increase in blister copper output.

TORONTO, CANADA—Consolidated Zinc Corporation, Ltd. has purchased a substantial stock interest in Siscoe Mines, Ltd. and will assume management. Consolidated Zinc has important mines and smelters in Australia and England.

ROME, ITALY-Italy's most promising uranium discovery is being developed in the Preit district of Cuneo Province by SOMIREN, the subsidiary of the Italian State Oil Agency, ENI.

KIMBERLEY, NEVADA—Kennecott Copper Corporation is negotiating to buy the ore reserves and copper mines of Consolidated Coppermines Corporation here. Coppermines ships its ore to Kennecott for milling at the present time.

VIENNA, AUSTRIA-Iron ore production in 1957 at Alpine Montangellschaft reached an all-time peak of over 3,000,000 tons.

JOHANNESBURG, UNION OF SOUTH AFRICA-Vanadium production from magnetite lenses in the Bushveld complex has been started by Minerals Engineering Company South Africa (Pty.) Ltd. When the second roaster is started, output will be 3,600,000 annual pounds of V<sub>2</sub>O<sub>6</sub>.

BOMBAY, INDIA—The Mineral Mining Co. (Private) Ltd. has made application to the Indian government for fluorspar prospecting licenses to cover recently discovered deposits.

CLIMAX, COLORADO-The Climax Molybdenum Company, Division of American Metal Climax, Inc. has started a deep mine preparation program at its Climax, Colorado mine. A 19-foot-diameter circular shaft will be sunk to the 1,000-foot level to expedite the exploration and dedevelopment program.

KIRKLAND LAKE, ONTARIO-The deepest ore now being mined in North America is gold on the 8,100-foot level of Wright-Hargreaves Mines Ltd.

SAN FRANCISCO, CALIFORNIA—Production of iron ore by western mines, ilmenite concentrate, and titanium metal reached all-time annual highs in 1957. Mercury output was the highest for any peace-time year since 1904.

SAN FRANCISCO, CALIFORNIA-Uranium purchases are due to get a fast step up in the 1959 United States government fiscal budget—up \$85,000,000 to nearly \$1,300,000,000. Both United States and Canadian mines will sell greater tonnage of concentrates.

SANTIAGO, CHILE-Three new copper refineries will be built in Chile in 1958 to process copper from small and medium sized mines. Plants will be built at Ventana de Quintero (north), Juan Soldado (south), and Ovalle (central).

ROME, ITALY—Italian mercury producers have formed Mercurio Italiano to sell production from the Monte Aniata and Siele properties.

PHOENIX, ARIZONA—Arizona mines set an all time high for copper output in 1957, 512,600 tons. The 1956 figure of 505,908 was the previous

## **New Company To Produce** Thorium from U<sub>8</sub>O<sub>8</sub> Tailing

A new company, jointly owned by Dow Chemical Company of Canada, Ltd. and the Rio Tinto Mining Company of Canada, Ltd., has been formed to pro-duce thorium and rare earths from byproducts obtained from uranium mining in the Blind River area of Ontario,

Operating properties in the Blind River district have already developed over 500,000,000 tons of uranium ore, all of which contain some thorium and rare earths. Although concentrations are small, earns. Although concentrations are small, total output could be appreciable as the combined milling capacity of the district is expected to be 34,300 tons per day, and output should be cheap because uranium pays for all mining, crushing, and crinding. While these true because it is a superior of the control of the contr num pays for all mining, crusning, and grinding. While these two by-products have been of no commercial importance to date, it is believed that both can easily be made soluble in the uranium leach and subsequently recovered from the uranium ion exchange tailing by ion exchange or chelating agents.

Blind River ores also contain pyrite,

cobalt, and nickel.

Rio Tinto of Canada is a subsidiary of the Rio Tinto Company, Ltd., of London and Dow of Canada is a wholly owned subsidiary of the Dow Chemical Company of Midland, Michigan.

## **Hindustan Steel Opens New Indian Iron Mine**

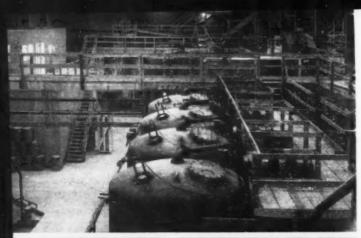
Installation of a \$5,500,000 ore handling system is planned by Hindustan Steel Private, Ltd. at its new iron mine at Barsua, Orissa province, India. The new unit, to be designed and constructed by Hewitt-Robins, Inc., will consist of a two-mile conveyor system and related crushing, screening, and storage facilities that will take the cre as it comes from the mine, process it to specifications, then load it into railroad cars for shipment to the new steel plant at Rourkela, 45 miles

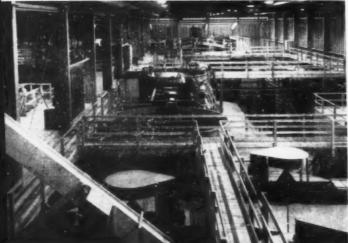
The Barsua iron deposits are found in an area approximately 35 miles long and a mile wide containing an estimated 150,000,000 tons of ore. Iron content varies from 54 to 65 percent. Construction of mine facilities has already begun and is expected to be completed by De-

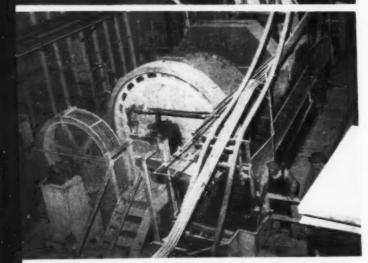
cember 1959.

Hindustan Steel's new iron mine and Hindustan Steel's new iron mine and the new 1,000,000-ton-per-year plant at Rourkela (See Minine World, October 1957, page 95) are part of India's five-year plan to improve industrial production and living standards of the nation. According to the plan, steel production will be increased to 6,000,000 tons of ingots a year by 1961 and hydro-electro power, transport, and other fields will also be expanded. also be expanded.

# Next Month-Industrial Engineering at Kennecott's Chino Mines







TOP: Interior view of Dawn Mining Company's 440tpd uranium plant built by Western Knapp Engineering Company. Shown in the foreground are the tops of 4 ion exchange columns; in the background are 2 of 5 mill bins rated at 350 tons each.

MIDDLE: This photo was taken from the opposite end of the mill building. Shown in the foreground are two of the leach agitators equipped with Devereaux-type props. The iron and uranium precipitation section is visible at the far wall.

BOTTOM: Grinding circuit consists of a Marcy 75, screenhead ball mill in closed circuit with an Esperanza classifier. Drag classifier overflow reports to a Krebs cyclone and the cyclone overflow is the feed to the acid circuit.

# Dawn's Uranium Acid Extraction

#### By DON HARGROVE, Assistant Manager Dawn Mining Company

Dawn Mining Company, a subsidiary of Newmont Mining Corporation, placed a new uranium processing plant in operation last August at Ford, Washington, 45 miles northwest of Spokane. This 440 ton-per-day facility features split-agitation, acid-extraction of uranium from the ore and a column ion exchange circuit. It is one of the few uranium mills in existence in the United States that uses column equipment. Most of the ore treated at the plant is furnished by the company's Midnite mine which is located on the Spokane Indian Reservation, 22 miles northwest of the mill.

Although this paper deals primarily with milling, a brief description of the mine is appropriate. The Midnite mine ore bodies occur along a north-south trending contact between granitic and metamorphic rocks. In general, the contact is exposed, or nearly so, where most ore has been developed. The contact dips to the east rather steeply in places, but underlies all of the known ore bodies. The rocks become progressively less altered to the east until, a few hundred yards east of the ore zone, impure limestone outcrops.

Mineralization, in general, is in the schist but it is not unusual to mine several feet of altered granite. Some of this granite is above average grade.

#### Mining and Hauling

Mining is open pit. The overall strip ratio of the deposits presently under development is approximately 3 to 1. The mining has been contracted by Isbell Construction Company of Reno, Nevada. The ore bodies are extremely well situated for an open pit operation as most of the ore occurs near the crest of a ridge, thus minimizing stripping and waste disposal problems.

The ore is deposited in a 1,000-ton mine ore bin located at a convenient spot near the lower ore body. From there it is loaded into 20-ton, cable-dump, semi-tra.ler, road trucks for the trip to the mill. Ore haulage is handled by Vic-Ore, a subsidiary of Beardmore Transfer Line, on a three shift, six day per week, contract basis.

The ore is weighed and moisture sampled as it enters the mill yard. Individual loads are sent to process or stockpile as requirements dictate.

The predominant uranium mineral is autunite, which occurs along the schistocity and cross fractures in the rock. This type of ore is, of course, quite different from the sandstone and conglomerate ores, found on the Colorado Plateau, the Ambrosia Lake District and the Wyoming deposits. We have three rather distinct types of ore: highly altered schist, altered granite and a tough blue unaltered schist. Some of the best ore grade occurs as unaltered rock.

These crebodies, fortunately, no not contain minerals which cause complications in an acid leach—ion exchange circuit. On the contrary, the altered schist furnishes sufficient ferric iron to very definitely assist

# Plant Features And Column IX

in the oxidation of the unaltered ore. A small amount of various other uranium minerals are apparent but are in the minority.

Small amounts of custom ore have been processed which contain primarily autunite and urano-thorite mineralization.

### **Test Work and Mill Design**

Late in 1955 Newmont Mining Corporation officials tentatively decided that the Midnite ore reserves were sufficiently large and of good enough grade to warrant mill construction. A few preliminary metallurgical bench tests had been made. Extraction was good. No interfering elements were present. In order to obtain the necessary metallurgical data upon which mill construction could be based, a 500-ton sample was processed through the National Lead Company's pilot plant at Grand Junction, Colorado. This ore was run through the resinin-pulp circuit. The slime content was almost twice the amount usually found in RIP feed so further tests were carried out at the Intermountain Station of the U. S. Bureau of Mines at Salt Lake City. These thickening tests proved to be satisfactory. The pregnant liquor was processed by ion exchange and found to pose no problems. Further test work was conducted in a Newmont laboratory and at the Colorado School of Mines Research Foundation.

Negotiations for a contract with the Atomic Energy Commission were being carried on concurrently with the test program. An equipment list, flowsheet, capital cost and operating cost estimates were also being prepared. By mid-1956 design requirements had been roughed-out sufficiently to allow requests for bids for plant construction to be sent out. Western Knapp Engineering Company was selected to act as engineering and metallurgical advisors and to construct the plant. The contract was of the cost-plusfixed-fee type. Detailed design was started in mid-August of 1956.

The mill was put on stream August 13, 1957. The first yellow cake was produced on August 21st, approximately 20 months after the first test work was started.

### **General Design Considerations**

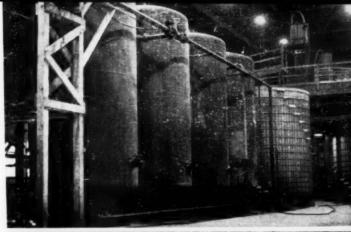
Due to the location in a relatively new and untried area, from a uranium standpoint, it was decided to build the plant in such a manner that the capacity could be increased if ore reserves justified such an expenditure.

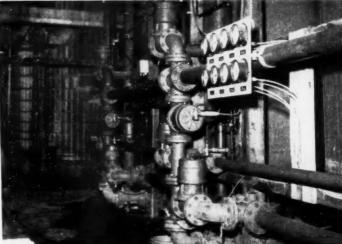
Weather conditions in the area with the attendant road restrictions dictated a fairly large ore-stockpile and reagent-supply be kept on hand.

In general, there is sufficient storage capacity of both for at least one month of operation. Ore supplies are much greater as mining is conducted for only about nine months of the year.

The mill building proper is of wood construction. Wood was chosen in lieu of steel because it was cheaper, acid resistant and more readily available.

The auxiliary buildings include: an office building,







TOP: Column ion exchange section consists of four, 8-by 15-foot units. Three columns are on the loading cycle and the fourth is on elution. Feed consists of pregnant uranium solution which carries colloidal slimes though visibly clear.

MIDDLE: This photo shows a portion of the bottom manifold system for the IX columns. The pressure gauges record column influent and effluent pressures. The pressure drop between columns gives a measure of resin bed permeability.

BOTTOM: Operator checks the IX control panel. This man also runs periodic colorimetric uranium determinations as well as nitrate and acid control checks in the IX circuit. Concentration ratio in the IX circuit is 20 to 1.

### **Dawn Mining Company**

change room, power plant, laboratory, garage and the crushing plant. All of these buildings are steel. All are prefabricated except the crusher building. Central heating is furnished by two Ames fully automatic boilers. All power and pipe lines between buildings are buried leaving a clear area for traffic.

Process handling equipment, of

course, had to be acid proof or as nearly so as possible. A great deal of time was spent on this phase of design. Wooden tanks, constructed of 4-inch thick Douglas Fir, were selected for practically all process tank requirements. The staves are chamfered. The hoops are enclosed in polyvinylchloride, semi-flexible pipe and the lugs are protected by polyethylene sheets. Launders were built of wood fastened by stainless steel nails and bolts.

Agitators are Devereaux type using rubber covered shafts and impellers. Thickener mechanisms are rubber covered using stainless steel rake shoes. Thickener cones are rubber lined.

Pulp piping is rubber-lined. Hoses are used where possible for pulp transfer. We have found hoses to be extremely satisfactory for handling both pulp and solutions. Saran-lined pipe for solution handling has a very definite advantage over rubber-lined pipe because the former pipe can be cut, threaded and flanged in the field. Rubber-lined pipe was factory fabricated to exact lengths with matching flange bolt-holes for field assembly. It is easy to imagine the difference in engineering costs attendant to the two types of piping.

In general, it has been found that the use of saran-lined pipe on pump suction and discharge manifolds, followed by hoses for long runs, is optimum for acid solution handling.

### Pumps

Pumps deserve special mention. Due to stockpile and tailing disposal considerations, an almost level site for mill construction was selected. This feature necessarily increased the number of pumps.

There are several different types of pumps in use. As nearly as possible, however, rubber-lined Vacseals were specified for both pulp and solution. There are 4 sets of 2 centrifugal pumps (one and a spare) handling pulp. These pumps are equipped with Conoflow operators. Impeller speed is controlled by air-pressure differential obtained by a bubbler pipe inserted near the pump suction in the sump. Pulp levels can be controlled within 1-inch by the use of the Conoflow operator in connection with a variable-speed drive.

Valves are another critical maintenance problem. Air-operated diaphragm valves are used on the ionexchange columns; hand-operated diaphragm and pinch valves are used on other solutions. Both have been found to be highly satisfactory. The only valves used on pulp lines are the

### Technical Data-Dawn Mining Company 440 TPD Uranium Mill

### Grindina

Ball Mill discharge Drag classifier overflow Cyclone overflow (Feed to Leaching section) Cyclone U. F. 78-80 percent solids 60-63 percent solids 3 percent +28 mesh 45-47 percent -200 mesh Approx. 80 percent solids

### Leaching

6 Agitators (size 16- by 16-feet)
1 Agitator (size 10- by 10-feet)
4 Thickeners (size 60- by 12-feet)
Type of Leach
1 Leach
1 Leach
2 agitators and 1 thickener)
Overall leach extraction
(both 1st and 2nd stages)
1 SO Consumption in leach circuit
Temperature 1st stage leach
Retention time 1st stage leach

each 19,350 gallons each 4,710 gallons each 244,000 gallons Split Agitation 65 percent

96 percent

100 pounds/ton of ore 35° C.
2 hours

### IX Feed Characteristics

Free acid (H<sub>2</sub>SO<sub>4</sub>) concentration Ferric iron concentration U<sub>8</sub>O<sub>8</sub> Concentration

### IX Circuit Characteristics

Cross sectional area per column
Total No. of columns
No. on loading cycle
No. on stripping cycle
Volume of resin per column
One bed volume
Flow rate during loading cycle
Flow rate per square foot of
column cross-sectional area
Resin type
Resin size
Theoretical adsorption capacity
of resin
Adsorption capacity actually

4 grams/liter 2 grams/liter 0.5 grams/liter

50 square feet
4
3
1
270 cubic feet
2,025 gallons
300 gallons/minute
6 gallons/minute

Amberlite 400 Minus-20-Plus-40 mesh 4.2 pounds U<sub>3</sub>O<sub>9</sub>/cu. ft.

3.0 pounds U2O4/cu. ft.

### Elution

Eluate Strength
Nitrate
Acid
Concentration ratio in IX Circuit
Eluate Flow Rates
H.SO, Consumption in IX Circuit
HNO<sub>8</sub> Consumption in IX Circuit

### 35-50 grams/liter 25 grams/liter 20 to 1 30 to 60 gallons/minute 10 pounds per ton 4 pounds per ton

### Other Reagent Consumptions

CaO as Ca(OH)<sub>2</sub> for Fe and calcium precipitation
Ammonia (anhydrous) for Fe and U<sub>2</sub>O<sub>3</sub> precipitation
Separan
Balls
Power (entire plant)
Fuel for boilers

5 pounds per ton2.5 pounds per ton

0.28 pounds per ton 0.8 pounds per ton 35 KWH/ton 2.4 gallons per ton thickener underflow valves. These latter are lightweight, fabricated, stainless-steel, gate valves which have proven to be satisfactory from an operational standpoint, as well as capital costwise. Other pulp valving is accomplished by the use of wooden or rubber plugs.

All electrical wiring was specified with neoprene cover. The cable trays are covered with transite. Conduit, in general, is semi-rigid plastic pipe.

### **Crushing and Sampling**

The crushing and sampling plant is not unique in any way except for the use of a Universal Engineering Corporation Wobbler feeder. This type of feeder was installed to help eliminate some of the trouble expected from wet, sticky ore. All sample cutting and preparation procedures have been reviewed and approved by the AEC. Custom shippers are paid AEC Schedule 5 (revised) prices according to ore grade. The ore, having been crushed and sampled, is delivered at minus %-inch to one of five mill bins by a conventional belt tripper.

These bins are 20- by 40-foot steel tanks each having a live load capacity of 350 tons. They are discharged by means of slide-plate-type belt feeders.

Grinding is accomplished by one Marcy 75 screen-head ball mill discharging at approximately 78 percent solids. The discharge is diluted to 60 to 63 percent solids in a drag-type Esperanza classifier. The classifier overflow is pumped to a 10-inch Krebs cyclone. It is possible to maintain a 50 percent solids cyclone overflow without producing more than 2 or 3 percent plus-28 mesh material. This is sometimes difficult to do on hard ore without sacrificing tonnage. A typical screen analysis of the cyclone overflow is as follows:

+ 28 Mesh - 3.0%

+ 40 Mesh - 4.0% + 65 Mesh - 15.0%

+ 100 Mesh - 11.0%

+ 200 Mesh - 20.0% - 200 Mesh - 47.0%

The product varies somewhat with type of ore being ground. A fine grind is not necessary from a metallurgical standpoint but is most desirable from a materials handling standpoint.

### **Extractive Metallurgy**

It is of interest to note that better extraction has been achieved than original test work indicated. The test work covered a wide range of acid strengths, material sizes, temperatures and rentention times. Optimum economic conditions seemed to require a

### How Ion Exchange Works In Columns

- Pregnant, uranium-bearing leach solution which has been clarified (either by thickening, filtration or both) is passed through a bed of anion exchange resins contained in a series of vertical columns. Uranyl sulphate complexes in solution are selectively adsorbed on the resin and feed continues until uranium is detected in the effluent of the final column.
- The lead column is taken off the feed stream and rinsed with water to displace remaining pregnant IX feed.
- At the same time a column is backwashed with water to flush out slimes which accumulated during adsorption cycle.
- 4. Column goes on elution cycle. Uranium is stripped from the resin by introducing an acidified eluting solution at about 1 mol in nitrate ion concentration. Eluate goes to precipitation section of mill.
- Column is given a sulphuric acid rinse to remove nitrate and poisoning ions from resins and then a fresh water rinse. Following this column goes back on loading cycle.
- 6. Uranium is precipitated from the eluate using ammonia (or other alkaline reagents); filtered; dried and drummed for shipment.

### Terms for Column IX Metallurgy

BACKWASH: Passing water from bottom to top of a column (the reverse of flow during adsorption and elution) which has just been taken off the adsorption (loading) cycle. Backwashing flushes out colloidal slime which permeates or accumulates on top of resin bed. A certain amount of this slime is introduced with IX feed.

BLINDING: Any reduction in resin permeability; usually caused by accumulation of slimes carried into column with IX feed; it is noted by pressure differentials recorded on gauges at effluent of a series of columns. It is controlled by backwashing and proper sizing of resin beads in the bed.

BREAKTHROUGH: When traces of uranium show up in effluent of the final IX column during a loading cycle.

COLUMN: A rubber-lined or stainless steel enclosed vertical cylinder containing a bed of sand and gravel on which rests a bed of anion exchange resin beads which occupy about half the vertical height of the unit. The size varies slightly; at Dawn a column is 8 feet in diameter by 15 feet high. For ion exchange purposes, columns are usually arranged in series of 2, 3, or 4 and they are fitted with suitable manifolds, piping and valving for feeding, discharging, flushing, and solution circulation.

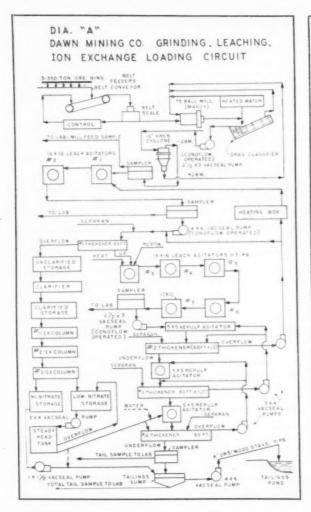
HIGH NITRATE BARREN: First portion of solution volume in effluent of column on load cycle. This solution is high in nitrate but low in uranium concentration. It is used as wash on the tailings. (First 20,000 gals.)

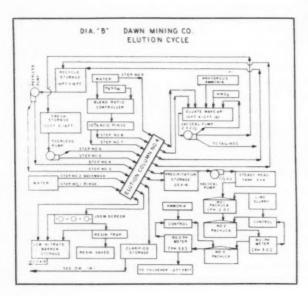
LOW NITRATE BARREN: All barren except the first portion of solution volume in column effluent during load. This solution contains some backwash water and is low in uranium and nitrate concentration. It is used as a wash on the final CCD thickener in slime washing circuit; a portion of this solution is bled to the mill tailing line.

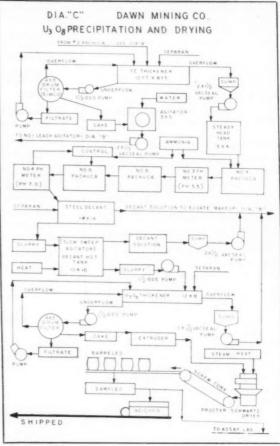
RINSING: When a column is taken off of adsorption, it is rinsed with water to displace pregnant IX feed which flows on through next succeeding columns on stream. At end of elution cycle the column is acid treated and water rinsed to remove eluate which is high in nitrate ions but low in uranium concentration. The displaced high nitrate solution is returned to eluate make-up. Acid rinse helps regenerate resin by removing poisons.

URANIUM LEAKAGE: Synonomous with breakthrough; trace amounts of uranium in the effluent of a column.

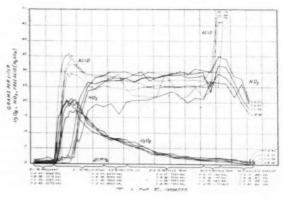
### Dawn Mining Company-







BELOW: Curves show changes in column effluent composition during elution cycle and can be correlated with table on opposite page and elution flowsheet.



minus-20 mesh grind, 130 pounds of  $\rm H_2SO_4$  per ton, agitation temperatures of 50° C. and 16 hours retention time in a straight, multi-stage agitation circuit to achieve 90 to 92 percent extraction. By using approximately the above conditions, but with a split leach circuit, over 96 percent extraction has been averaged in actual practice.

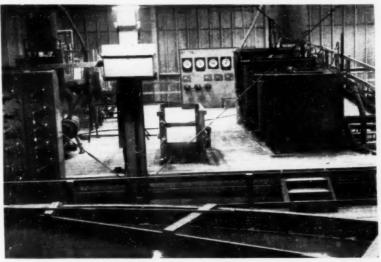
The split agitation circuit is set up to receive cyclone overflow in No. 1 and 2 agitators in series. The cyclone overflow is diluted to 18 to 20 percent solids by the addition of No. 2 thickener overflow solution. This solution was to be heated sufficiently to an approximate temperature of 50° C. in No. 1 & 2 agitators. Free acid content of No. 2 thickener overflow averages about 6 grams-per-liter. Retention time is about 2 hours in the first two agitators. They are discharged by means of airlifts to prevent sanding at the low density.

Test work on this initial leach phase indicated 80 to 85 percent extraction. It has been difficult to achieve more than 75 percent extraction, mainly due to lack of heat. This is being remedied.

No. 1 thickener underflow is pumped at 60 percent solids to the second bank of five agitators. Make up acid is added to the first of these at the rate of about 100 pounds-perton of ore. Free acid strength in this second bank of agitators gradually declines from 35 grams-per-liter in the last of the series. Ferric iron content is approximately 6 grams-per-liter.

The overflow from the last agitator is pumped to a 4- by 5-foot repulper, diluted by No. 3 thickener overflow to about 20 percent solids and fed to No. 2 thickener. The acid and ferric iron balance in the solution is rather difficult to maintain, as the high concentrations of acid and iron which result in good extraction are not conducive to high resin loadings in the IX circuit. A reasonable balance is preserved and maximum resin loading is sacrificed for better extraction as long as there is sufficient time for elution.

Pre-plant construction test work, as well as theoretically equating the solution values in the CCD circuit, indicated less than 0.5 percent soluble loss. This loss was not greatly increased, theoretically, by use of the split agitation circuit as long as high recoveries are achieved in the first stage of agitation. Lower first stage recoveries, of course, introduce more uranium into No. 2 thickener with attendant higher soluble losses from No. 4 thickener underflow. These losses,



ELUANT undergoes 2-stage precipitation in 2 banks of 3 Pachucas. Gypsum and ferric hydroxide are precipitated by adjusting pH to 3.3 to 3.6 with lime and ammonia. Uranium is precipitated with ammonia at a final pH of 6.8 to 7.0.

however, have not exceeded 1 percent. The good recovery has been achieved by maintaining approximately 60 percent thickener underflow densities and as much wash as can be handled by the IX circuit. No. 4 thickener wash solution is made up of IX low nitrate barren solution which is sometimes diluted with fresh water, if found necessary, to reduce ferric iron concentrations. In practice, proper ore blending will accomplish the same purpose and is done whenever possible.

### **Thickening and Tailing**

The CCD circuit consists of four 60- by 12-foot thickeners. Underflow pulp is diluted from 60 percent to approximately 20 percent solids and repulped between each thickening stage. The repulping step was found to be mandatory as the pulp flocs formed by the use of Separan carried soluble values through to tails if not thoroughly broken down.

Thickener underflow pumps are 6inch Dorrco, duplex, low-pressure diaphragm type equipped with Reeves Drives. Stroke length is left constant. Speed is regulated to adjust flow rates.

Tailings are pumped through 4-inch hoses and 4 or 5-inch wood-stave pipes to a 50-acre tailing pond located about 1,000 feet south of the plant. Densities vary from 20 to 50 percent solids. There has been no trouble with the lines sanding. The wood stave pipe is banded with PVC covered wire to minimize corrosion should leaks occur. All tailings are impounded including the solution.

### Clarification

The ion-exchange feed solution produced by No. 1 thickener overflow is as clear as can be expected. The colloidal slime fraction is difficult to filter out. A conventional leaf clarifier was installed to remove colloidal slimes but was found to be a major

#### **ELUTION SEQUENCE**

Step	Description of Column Influent	Destination of Column Effluent	Approximate Volume	Rate of Flow Column Influent	Time Consumed
1.	Water Rinse	To next column (on loading cycle)	4,500 gallons	300 gallons per min.	15 minutes
2.	Water Backwash	To low nitrate barren tank	12,000 gallons	200 gallons per mi 1.	60 binutes
3,	Recycle Eluate (E-1)	To IX pregnant feed tank	2,070 gallons	57 gallons per min.	36 minutes
4.	Recycle Eluate (E-1)	To iron, calcium, and UaO8 precipitation section	6,000 gallons	57 gallons per min.	105 minutes
5.	Fresh Eluate (E-2)	To iron, calcium, and U <sub>3</sub> O <sub>8</sub> precipitation section	2,000 gailons	57 gallons per min.	35 minutes
6.	Fresh Eluate (E-2)	To eluate recycle tank	6,925 gallons	57 gallons per min.	121 minutes
7.	5 percent H2SO4 Rinse	To eluate recycle tank	1,165 gallons	39 gallons per min.	30 minutes
8.	Water Rinse	To eluate make-up tank	1,870 gallons	31 gallons per min.	60 minutes
	TIME PER EL	UTION CYCLE		462 minutes =	7 hr. 42 min.

### Dawn Mining Company

problem as well as expense. Clarification, even of liquor that was visually clear, was found to be necessary for IX feed due to the fineness of the resin which acted as a filter and formed an impervious layer on top of the resin in the columns. The finer fraction of the resin was replaced with plus-40 mesh material. Unclarified solution is now fed to IX. Slime accumulates all through the bed, some is carried out with the barren solution, the rest is backwashed out through the top of the column after each load cycle.

### Ion Exchange

Ion exchange is accomplished in four 8- by 15-foot columns. Each column is equipped with a bottom distribution piping system on top of which is a bed of sized gravel and sand. The strong-base anion-exchange resin rests on the sand and occupies a 270 cubic-foot space up to the upper distribution piping. The resin is loaded with uranium as a uranyl sulphate during the adsorption cycle.

Pregnant, ion-exchange feed solution is known to contain uranium ions, in at least four different forms, these are: the uranyl cation (UO<sub>2</sub>++); un-ionized uranium sulfate (UO,SO,); divalent uranium complex [(UO2(SO4)2)-2]; and a tetravalent uranium sulfate complex [UO,(SO<sub>4</sub>)<sub>3</sub>)-4]. Depending upon the amount of free acid and concentration of sulfate and bi-sulfate, ferric iron and other competing ions, the resin usually adsorbs from 2.5 to 4 pounds of uranium per cubic foot. During the loading cycle there are

three columns on stream. The lead column receives the solution at the top under pressure, it is forced through the resin bed, then flows out through the bottom distribution pipes and up into the top of the next succeeding column on stream. Pressure drop through the column is an indication of the permeability of the resin bed. Pressure drops should be on the order of 15 pounds-per-column. Flow rates in general are conceded to be 5 or 6 gallons-per-minute-per-squarefoot of column cross-sectional area. To date it has not been possible to attain more than 6 gallons-perminute-per-square-foot without unreasonable pressure development.

Periodical uranium analysis of the effluent and comparison with the feed solution, using barren solution as a standard, establishes the degree of load in each column at any given time. In practice a column is considered to be loaded and ready for elution when the uranium content of the influent and effluent of the lead column are equal and the second column in line shows a break through of perhaps 10 percent of the uranium content of the IX feed solution. The third column strips nearly all of the remaining uranium from the solution, producing an almost barren effluent.

### **Elution Cycle**

After a column is loaded it is rinsed with water. The rinse water displaces most of the solution which continues on through the next succeeding columns. After rinsing, the column is backwashed. This step is accomplished by the addition of 200 to 250 gallons-per-minute of water through

the bottom distribution pipes. The resin bed is raised, loosened and resorted. Slime particles are carried upward and out with the backwash water. Fine resin has a tendency to be carried out in the ascending stream if the velocity is great enough. The backwash stream is run through a 100-mesh screen to trap any fine resin carried out of the column.

After the backwash has been completed the actual elution begins. Ammonium nitrate is used as the eluate. The eluate is made up from nitric acid neutralized by anhydrous ammonia to achieve the nitrate content. Excess nitric acid is added to maintain the proper acidity.

Eluate strength has varied from 50 grams-per-liter of nitrate and 25 grams-per-liter of acid to 30 grams-per-liter of nitrate and 25 grams-per-liter of acid. Curves have been made of the elution cycle to determine optimum operating conditions.

The first eluate added to the column is pumped from the recycle eluate tank. This liquor contains from 1 to 2 grams-per-liter of uranium. It is added through the upper distribution pipe manifold, just above the top of the resin bed, and percolates downward. Flow rate varies from 30 to 60 gallonsper, minute. The first bed volume, approximately 2000 gallons, is sent to the IX feed storage tank. This solution contains practically no acid, nitrate or uranium. As values begin to appear the effluent is sent to a concentrated eluate storage tank.

The curve taken from these eluate flows is very interesting. The uranium and acid curve start up together, very steeply, from 1 or 2 grams-per-liter to 20 or 25 grams-per-liter. The nitrate curve lags by some 1,700 to 2,000 gallons and then it too rises abruptly as the nitrate requirements of the resin are nearly satisfied. The uranium curve drops almost as steeply as it rose until it is down to 4 or 5 grams-per-liter at which time it tapers off gently to the end of the elution. A typical set of curves are presented with this report.

The most concentrated portion of the eluate reports to precipitation storage. The next step is fresh eluate to precipitation and then fresh eluate to recycle. This fresh eluate to recycle step insures a more concentrated eluate to be precipitated. The last steps are acid rinse and water rinse. The acid used is sulphuric. The function of the strong acid rinse is to help regenerate the resin after each elution by removing interfering ions from sites which could be occupied by



DRUMMING of yellow cake requires little attention. Wet pellets are formed by extruding concentrate filter cake through a screen; pellets travel on steel conveyor through Proctor Schwartz drier. Dried pellets are screw conveyed to drums.

uranium when the column is put back on load stream.

Rohm and Haas, Amberlite 400 anion resin is used. The nitrate capacity of this resin is about 4.2 poundsper-cubic-foot. When a newly eluted column first goes on stream in the number three or final position, the first 10 bed volumes, approximately 20,000 gallons, of effluent has a fairly high nitrate content. This portion of the barren solution is split out of the stream and reports to a storage tank where it is added gradually to the pulp tailings as a wash. Nearly all of the low nitrate barren solution is added to No. 4 thickener as wash.

Concentration ratio achieved in the IX step is approximately 20 to 1 under average conditions when the IX feed is assaying 0.5 or 0.6 gramsper-liter in uranium.

### Precipitation

The concentrated eluate is pumped at the rate of 20 or 30 gallons-perminute to the first of three 6- by 4foot Pachucas. A 20 percent lime slurry is added to the first and second Pachucas. The lime is added to the first by hand valving, the second by means of an automatic controllerrecorder pH meter. The third Pachuca receives gassified ammonia regulated by another controller-recorder pH meter. Final pH in the third Pachuca is 3.3 to 3.6. The lime slurry precipitates as gypsum and also precipitates nearly all of the iron as a ferric hydroxide.

The overflow from the third Pachuca reports to a 12- by 8-foot thickener. The thickener underflow is pumped to a 4- by 3-foot stainless steel, drum filter. The cake is repulped and returned to No. 1 agitator in the main leach circuit. This cake usually assays 1 or 2 percent uranium. The filtrate is returned to the iron thickener. The overflow from this tank forms the feed for the second bank of three Pachucas for U3O8 precipitation.

Ammonia is added to the first manually and to the last by another automatic controller-recorder. Final pH is from 6.8 to 7.0, completely precipitating the uranium. The overflow from this last Pachuca is thickened. heated to approximately 90°C., again thickened and then filtered on another 4- by 3-foot drum filter. This filter is equipped with a roll discharge. Filtrate reports to one of two eluate makeup tanks.

The filter cake averages 50 percent solids, but seems quite dry. It is dropped through a chute to an extruder which is part of the Proctor and Schwartz drier.

### **Drying and Packaging**

The Proctor and Schwartz drier is heated by steam to 280 or 290°F. It is equipped with a variable speed, punched, stainless steel conveyor which transports the 3/16-inch extruded pellets slowly through the drying chamber. Blowers circulate the heated air which is sent through a water-washed rotoclone before being discharged to atmosphere. After leaving the drier, the yellow cake is conveved by a series of screw conveyors to steel drums. Before entering the chutes leading to the drums it is forced through a 4-inch screen. The drums are hooded. Dust loss is negligible.

The drums of concentrate are sampled and the moisture taken. They are then weighed, numbered and sealed. They are shipped in less than 50-drum lots to the AEC at Grand Junction, Colorado, by truck.

The final concentrate grade, reported as U,O, although the precipitate is ammonium diuranate, must be 75 percent to avoid penalty. There are also several maximum impurity percentages that cannot be exceeded without penalty.

### **Manpower Requirements**

There are a total of 80 men on the payroll distributed as follows:

Administrative	0	,	C	)f	fie	c	e	5	ın	d	l					
Warehouse																7
Mine						*				*						10
Scale House																3
Laboratory .												*				4
Miscellaneous									*						*	1
Mill				,								*				55
																-

four complete shifts of six men per shift under the supervision of a shift boss. The men work 42 hours-perweek. The maintenance crew is conposed of 6 mechanics, two electricians and two carpenters. These men are working 48 hours per week under the supervision of the Master Mechanic.

The crushing plant is operated by two men, six or seven shifts per week. The yard crew is composed of two men. There are three sample preparation men and three men on the bull gang. This makes a total of 63 actual jobs at the plant. The other 7 men are relief to fill in the work week. Assuming a normal production of 440 tons-per-day, 7 tons-per-man shift is being processed.

This plant is equipped with quite a number of instruments. There is no doubt about the desirability of automation when present day labor costs are considered. But, the instrumentation incident to automation should be kept as simple as possible and still do the job. For instance, a simple float actuating a mercoid switch is much more trouble free than a set of electrodes. If air controls are to be used, the operator will find it necessary to install oil filters, dessicators and a separate receiver for instrument air in the plant.

In conclusion I would like to express my appreciation for the kind assistance of the following people in the preparation of this presentation:

Mr. R. R. Porter, Consulting Metallurgist; Mr. R. B. Fulton, Manager-Dawn Mining Company; Mr. Paul Stucker, Mill Foreman; and Mr. Wm. Darlington, Chief Chemist.

THE END



CCD CIRCUIT consists of four 60-by 12-foot Dorr thickeners; using Separan, underflow densities of 60 percent have been maintained; load is usually controlled by adjusting speed rather than stroke of diaphragm pumps handling underflows.



LZK-1-p ROCKER SHOVEL LOADER looks surprisingly like the Eimco 12-B Rocker Shovel which was the first loader of this type in the world. Note the interested spectators at this model mine somewhere in the Soviet Orbit.

### Mucking Out Behind the Iron Curtain: Soviet Machines and Mining Methods

Complacency and smugness of the Free World received a deep shock from the recent Soviet launching of Sputniks 1 and 2. An even greater shock has been the realization, too late, that the Russians had carefully documented their plans and progress for the Satellites in the June 1957 issue of the Soviet amateur radio journal. Copies of the magazine were available but no one in the Free World had the foresight nor the desire to translate it into English.

To prevent a repetition of this oversight, the Editors of MINING WORLD commissioned Dr. George Rosu to make an immediate search for and translation of all articles, both in Russian and Satellite technical publications, dealing with the mechanization of the Soviet Orbit mining industry.

What about Russian mine mechanization?

In this first article a review of the Soviet system under which mining, and all industries, operate, is given. Also a report of mining equipment and practices. A special table summarizes mechanical loading equipment in the Free and Iron Curtained Worlds.

A second article will detail some Russian claims as to shaft sinking machines and records.

#### By DR. GEORGE ROSU

The working conditions of the Soviet mining machine industry demonstrate how true is the accepted maxim that the function creates the organ. Soviet mining, particularly of non-ferrous ores, is neither sufficiently

developed to need full-scale mechanized operation nor does it produce for a competitive market. Its main function is to fulfill Plan production quotas set by the Government. Plan fulfillment, however, is a quantitative order given to production units for which considerations of technical and economic efficiency play a secondary role. Success in planned production is assessed by quantity, not by the paramount yardsticks applied in a competitive climate, namely, quality and lowest production costs attained under

the most favorable conditions of social welfare.

In Russia the quantity of nonferrous ores produced annually is planned to cover only the needs of the other planned production goals (alloys, machines, etc.). This conformity to Plan excludes the play of the supply and demand law and, thereby, the pressure for continuous adjustment to market conditions.

Under these circumstances, mechanization of mining operations is a planned and restricted activity. It may develop only at the pace permitted by the opportioning through Plan of machines, tools, technicians, electric power, etc. and not at the pace set by competitors. No mining concernhowever primitive its operation and high its production costs-is ever priced out of the Soviet market by another highly mechanized and efficient mining concern. Price differences, realized over and above the planned production costs (as 'profit' does not exist under the Soviet system, either as a concept or as economic result), are collected as budgetary revenue. In turn, losses sustained by primitively worked mines are compensated from the State budget. Prices of metallic ores are recondite averages

Dr. Rosu is a well-known writer on international affairs who has made many contributions to leading oil journals. Documentation for this special mining report was gathered by him from Soviet, Satellite, and European sources.

arrived at through this triangular arithmetic.

### **Mining Not Competitive**

As self-financing is excluded under the Soviet economic rules, the manager of a mine may mechanize operation only to the extent permitted by Plan directives and budgetary appropriations specifically earmarked for this purpose. Conversely, the manager is bound to accept whatever tools, machines, etc. are supplied by the distribution center, regardless of their quality and fitness, simply because this is his sole supply source. Briefly, the Soviet mine manager-unlike his Western counterpart-is not worried that competitive costs may force his enterprise out of existence. is little concerned with acquisition of high capacity combination machines. and even less so with operation diversification.

As in almost every walk of Soviet life, so also in the mining machine domain there are genuine shadows and feigned lights. But dearth of genuine information makes it difficult to separate the wheat from the chaff. i.e. to assay what is actual achievement and what is merely claimed

It is true that the newer tendency in the Soviet technical literature is to disclose more about their own achievements and errors, and to speak more objectively about foreign discoveries and performances. If we lend credence to an official statement published some time ago in Pravda, the era of boosting the Soviet "technological morale" by tacitly overlooking whatever good and original the West thought or did-which was a law under Stalin-has now come to en end. Nonetheless, the old and deeply entrenched habit of praising every Soviet achievement as unsurpassed, and of looking down at the "unprogressive capitalist technology" has not faded away altogether.

Viewed from the practical angle, however, the difference for the West between the old and the new era is not impressive. Formerly, Western ideas and models were used ad libitum without acknowledging it, or revealing the source. Conditions have now so changed that "borrowing" from the West is not only encouraged and facilitated but quite often admitted. In the newly inaugurated era-officially labeled as economic competition with the West-scientists and technicians are also called upon to attain Soviet supremacy in their fields of endeavor. Western achievements have thus become instrumental in

### Sales Pitch From the Soviet World

This is a reproduction of a page from a sales brochure detailing the advantages of the Centrozap LZK-1-p Rocker Shovel Loader. Visitors at International Industry Fairs in Asia and Africa are urged to buy made-behind-the-curtain-machinery of all types.

### ROCKER SHOVEL LOADER

LZK-1-p

The speedding of different operations in mines requires mechanisation of the most labour absorbing activities, especially loading, an increase of man-power to speed loading being mostly impossible in limited underground space, where it would interfere with hygiene and labour-safety regulations.

The Rock Shovel Loader ŁZK-1-p solves this problem in most cases.

The results attained till to-day indicate that this machine fulfils its duties me effectively, playing an important part in mechanisation of loading — one of t effectively, playing an in heaviest duties in mining.

This machine belongs to the group of loading shovels and has been especially designed in for loading rocks horizontal and sloping underground galleries, mine tunnels etc. of at least 2.40 m height. It can be used in iron ore mines and on the surface as well.

This machine has many special advantages, such as small overall dimensions: owing to it the machine requires minimum space for handling, being enabled to work in difficult conditions. Moreover, it is marked with maximum compactness of structure elements, high grade of used materials and accurate assembly.

The loading cycle starts by linking an empty tub to the loader placed at acertain distance from the cuttings, tramming the unit to the cuttings, attacking afterwards the excavated product with the dipper lowered to the ground.

While the dipper is rooting into the heap, the operator jibs it with a quick up and down oscillating motion by means of the hoisting lever, thus obtaining very compact dipperfuls. When the dipper is filled to capacity, it is being hoisted and at the same time the cradle rolls back until the dipper is discharged into a tub.

After discharge the unit moves back, then it takes run again, and with the lowered dipper starts another cycle.

According to the size of broken material and to the operator's skill, a tub of 1 cub. m. capacity can be filled in 6 to 7 bitings. The projection distance of cuttings from the dippers is controlled by the lever.

To ensure continuous work, a good supply of tubs should be organized. Apart from front loading, side loading is also possible.

One of the advantages of the machine is the fact, the machine is the fact, that the dipper with suthat the dipper with su-perstructure can swing to the right or left up to 30° from the track axis, which allows to sweep the bro-ken material from both sides of the track, thus increasing the front of leading. leading.

The Rock-Shovel Loader consists of three essential units: wheel undercarria-ge, superstructure with redevice, cradle with dipper.

Furthermore, the loader comprises following ele-ments as component parts of these three units: travel

drive gear, hoisting engine, capstan with reduction gear and chain for the lowering and hoisting mechanism, a centering device, a self-acting coupling device and steering levers with reduction gear and chain for the lowering and hoisting mechanism, a centering device, a self-acting coupling device and steering levers with reduction of the coupling device and steering levers with reduction of the coupling device and steering levers with reduction of the coupling device and steering levers with reduction of the coupling device and steering levers with reduction of the coupling device and steering levers with reduction of the coupling device and steering levers with reduction gear and chain for the lowering and hoisting mechanism.

compressed air tupes. Both the undercarriage and the hoisting device are driven by two <del>plentic and inteschangeable</del> air engines. These are 5-cylinder piston star expansion engines with alternate direction of

The wheel gauge is adjustable from 470 to 650 mm

The Rock Shovel Loader LEK-1-p has several remarkable advantages which place it among the most efficient machines of this type. Its outstanding foundatives are the possibility of using it for any kind of crushed material, a closed, rigid and compact construction, short body and anal overall allowers of the properties of the properties

#### SPECIFICATION

Capacity of dipper:									. 0.2 m8
Output of loader:							*		.20—60 m <sup>3</sup> /bour
Loading beed:							*		2,3 m
Gauge:									670650 m
Prumber of motors:		× +			+			*	. 1
Mutor power:				*					. 12 10 each at 650 r. p. m.
Air compression:				-		*			. 3-5-7 atm.
Leagth of machine									. 26.00 mm
	in transpor								. 1875 mm
Wigh of machine									. 1300 mm
	in treesper	4	*						. 880 mm
Maximum height in				*	*				. 2300 mm
	transport		*					*	. 1400 mm
Weight of machine:					*				. 2830 kg
Travelling speed:					*			*	. 1 m/sec
Maximum loading v	weight: .						*	*	. 550 kg



Characteristics Co	ompressed Two Dru			Two I		ectric Dr	iven	T	iree Drui	ms
Drum diameter, inches	6.3	11.4	11.4	13.2	17.7	11.4	16.5	11.8	Name .	17.7
Drum width, inches	2,36	5.9	5.9	-	8.3	6.4		6.4	5.9	8.3
ROPE SPEED:										
Full, feet per second	1.3	3.3	3.3	3.8	3.2	4.1	3.3	3.6	2.9	5.1
Empty, feet per second	1.6	3.8	4.8	5.2	4.6	5.4	5.2	4.8	4.1	7.2
Diameter haul rope, inches	0.23 1	0.47	0.47	0.55	0.67	0.47	0.55	0.47	0.61	0.69
Motor horsepower	3.5	13.6	16.0	38.1	61.2	19.7	27.9	16.0	32.0	61.2
Scraper capacity, cubic feet	2.5	5.3	5.3	10.6	21.2	7.0	10.6	5.3	10.6	21.2

precipitating Soviet initiatives for technical progress.

### Technology from the West

East European scientists seem to fare less well in this respect. There is little more illustrative of the practices prevailing in those countries than a letter to the Editor" (unsigned but, obviously, written by an engineer), published in the Hungarian daily Nepszabadsag (Budapest) of December 27, 1956. Because of their rare documentary value, these two paragraphs of this letter will be quoted verbatim:

"Our technical intelligentsia could not be entirely sealed off from the West during the past years (i.e. prior to the uprising of October 1956) because it was through technical literature and periodicals that they maintained a constant contact with the Western world which was continuously vilified by our former politicians who never distinguished between

politics and science.

"The technical literature and periodicals of the Western worldcondemned to death by our politicians -were indispensable because they were the source of the majority of our 'original innovations'; and because it was from these sources that our experts learned, and became acquainted with many achievements of the technical progress. Perusal of Western mining periodicals enabled them to realize that they had been left far behind in technical research and the development of machines. Our experts compared the technical papers of the two worlds which were opposed to each other-or rather set against each other by our politicians-and easily discovered the contradictions and untruths in which these politicians wanted them to believe.'

### Mr. Khrushchev's Speed Up

The "new era" began in the Soviet Union with the issuance of the "technical theses" on July 11, 1955 that directed the scientists and technicians to modernize the Soviet industry, and to prepare it for the automation age. For this purpose, they have been advised to follow closely the technical progress and discoveries made in the West. A vast network of technical information centers and of libraries supplied with Western technical literature is being set up.

This initiative was given a new impetus by Nikita S. Khrushchev's reform of last April which aims at uprooting the age-old Russian bureaucracy, and at decentralizing industrial management. In the reformed organization, the key managerial entity is no longer the Ministry in Moscow but the State Economic Council (Sovnarkhoz) attached to each of the 105 economic administrative regions into which the Soviet Union is now divided. Each Sovnarkhoz is endowed with a technical information center, supplied by a central distribution authority in Moscow, with translations of all important discoveries and patents published in the West as well as of the main reports printed in Western technical journals.

This well-organized gold mine of Western ideas, discoveries, experience, blueprints of machines, and of general technical documentation prepared to be distributed to the smallest economic entities-even to plant managers-will certainly afford many a short-cut and speedier progress in the Soviet machine manufacturing. As in the past, there will be no restriction in using Western patented discoveries and, of course, no licensing fees will be paid for them. The past sporadic "borrowing" has now become a Government business. Seen from this angle, the "competitive coexistence" era looks like a game at which, tails or heads, the Soviet Union wins.

Reports from Europe indicate how fast and successful this "pirating" of Western reports and ideas has been in the field of the geological sciences. It is reported that the Russian State geologists have available to them about 4,500 very carefully indexed geological papers annually. In addition, an excellent system rapidly provides lengthy abstracts on Western articles. It is not unusual for up to 25,000 copies of outstanding Western geological works to be printed and distributed free or at a minimal cost to geologists and prospectors throughout the Union.

Surely the same speed-up and dissemination system is underway in regard to technical publications dealing with the mining and metallurgical industries.

Underground mining is, in general. a highly mechanized operation, except where labor is cheap. In the Soviet Orbit there is no pressure coming from organized labor for higher wage rates and social benefits or shorter working hours that may prompt a mine manager to attempt saving in costs through the use of machines; depletion and the need to mine low-grade ores is no incentive for mechanization either as cost differences are-as mentioned beforecovered from the budget. A fullmechanized mining operation is a very complex and costly undertaking for the countries of the Soviet Orbit. The large capital demanded for this purpose represent too big a bite into the limited investment funds they are able to accumulate annually. Besides, these funds are mortgaged in advance for defraving higher priorities.

### What Mining Methods Used?

In 1954 nonferrous and rare metal mining broke down into the following methods: open stopes 31.1 percent (including room and pillars, 18.9 in flat dipping beds); shrinkage stopes, 16.3; filled stopes, 10.3; top slicing, 19.4; sub level caving, 5.2; under cut caving, 17.4 (including block caving with long blast holes, 11.9 and block caving, 5.5); and other methods, 0.3.

It is officially urged to replace, wherever possible, the more expensive room-and-pillar and cut-and-fill methods through "stepwise" stoping. The latter is more adaptable for the older mines operated in those countries. with narrow tunnels, small shafts, and primitive ventilation. In such mines it is far more expedient to increase the mechanical security of the existing tools than to start mechanizing the operation.

As in every other domain of activity, the Plan also sets targets for mining mechanization. The annual targets are based on the capacity of the machines and tools in serial production at that time that may be supplied to mines. Long-range mechanization planning is based on the probability of constructing, at a certain date, a number of serial machines or of new types of mining machines.

### Soviet Machine Shortcomings

No less an authority than Professor A. O. Spivakoskyi had this to say last year about the subterranean transportation installations in Soviet mines. Among the shortcomings and lowquality products he quotes the quick wearing of the sprocket chains and of the sprocket wheels which cause frequent breaking of the chain conveyors. The chains' useful life is less than six months, and that of the cars even shorter. Dust and moisture tightness for most of the transportation machines leaves much to be desired, as the Soviet technicians have not apparently succeeded in producing a good dust and water tightness system. The same is true about the roller bearings of the belt conveyors which lack protection against dust and moisture.

About standardization he com-

"There is, at present, a wide variety of types of transportation installations used in our mines that complicates operation, and renders difficult the supply of spare parts and the repair. Too many models of installations are being produced in too many plants. It is necessary to specialize by plant the production of a single type of machine or implement, and apply the standardized profiles in their mass production.

"Modernization of the existing subterranean transportation installations and the construction of new machine types should be undertaken, and be based on the most advanced technology and models built at home and in the West. First and foremost, the service life of mining machines should be bettered and lengthened, respectively, through use of the lightest, most resistant and anti-corrosive metals and alloys, and the mechanical finishing of the spare parts should be improved through use of the thermic steel processing method."

Research and construction in mining transportation is limited mainly to solving partial and local problems, and to liquidating bottlenecks. As officially admitted, this sector needs radical improvements. This could be achieved through a national program in which there would be collaboration among the main scientific research institutes, as well as the projection, drafting, and mining construction organizations.

In East European countries, the situation is worse than in the Soviet Union. Some of them admitted that they were unable to duplicate Western models because of lack of properly tooled plant capacity and of the un-



WUP-20 PNEUMATIC HAMMER DRILL with air-water flushing mounted on a PWU-51 airleg pictured in a Soviet Orbit demonstration mine. Weight of drill is reported as 49.6 pounds and the airleg 47.4 pounds.

satisfactory level of research done in this sector.

Loading and transportation of both ore and waste as well as backfilling and tamping in the metal mines of the Soviet Orbit are done overwhelmingly manually. The rather primitive mining methods restrict the use of belt, flight, shaker, and duckbill conveyors to spotty operations. Transportation of ore from the working face often is done by wheelbarrows and by manhandled cars. These methods require a large manpower; thus, the overall efficiency is low.

#### Slushers and Scrapers

Slushers have been introduced in Soviet metal mines on a larger scale only since 1950; in Eastern Europe, however, they are still being used on an experimental basis.

Outstanding among Soviet-built slushers are the following types: LU-15 and B-10, powered by motors of 10.9 horsepower; the disassembling C-3 and M-20 types with two drums and 27.9 horsepower motors; and the C-25 with three drums and a 29.9horsepower motor. The most powerful Soviet slusher-apparently not yet in mass production-is powered by a 61-horsepower motor. (This compares unfavorably with Western-built slushers with 125- to 150-horsepower electric motors pulling scrapers of 4.5 to 6.5 cubic yard capacity.) In current Russian practice, however, mostly "baby" slushers are used with 8- to 15horsepower, compressed air driven motors; their usefulness is, knowingly, limited to loading floors without excessive faulting, as well as to small mines. Details on Soviet-built scraper hoists are listed in Table No. I.

Soviet-built scrapers vary in size and capacity to suit ore weight and fragmentation, as well as the haulage track. Their capacity is proportioned to the hoist (8 to 25 horsepower), the car content, (maximum 1.3 cubic yards) and the small stopes. It varies between 0.6 and 1.3 cubic yards. Practically all scrapers in use at present are of the open-bottom type. For fine grandular material the box scraper is used; for larger lumps, the hoe scraper with the back-plate shaped in angle or arch.

Soviet technical periodicals urge the construction of scrapers cast of manganese steel or even special alloy steels because their useful life is several times longer than that of welded scrapers, while their cost is 10 to 15 percent lower. But there are very few cast scrapers in use, and the annual production quota is modest. There have been some critical articles published in Soviet newspapers and periodicals to the effect that the scrapers are not resistant enough, and that their weakness was the cause of a low efficiency in loading operations.

Data on operational results with slushers in the Soviet Union is scanty, but here are some illustrative details on scraper operations attempted in a Romanian primitively organized metal mine at Baia Mare, with narrow stopes and equipped with sliding chutes lined with oak planks. Although pertaining to a single operation in one country, these details are, nonetheless, relevant to a great extent for the whole Soviet Orbit.

				Working	Working Clearance	Width of shovel		. Dipper		N's and Asses		Motor Rating	ting		Track	Performance (as indicated
	Loading Equipment	Манијастиго	Length	Width		conveyor in feet	width width in feet	cubic cubic feet	Weight in pounds	of motors	Locomotion	Loading	Rotation	Discharge	Width in feet	manufacturer)
_	CONVEYING EQUIPMENT: 1—Scraper Chain Conveyor P-3 2—Rubber Belt Conveyor P-4	U.S.S.R. U.S.S.R.	15.88	3.51	58.28	1.31			2,094					2.4	1.97-2.95	45 t/h <sup>3</sup>
head	11 SLUSHERS 1 Joy-Sullivan 2 Salzzitter	Joy Mig. Co., Pittsburgh, Pa.	24.11	8.20	6.00			28.24	18,298	1		20			1.80-2.95	1,412-1,765
	3—Wolff Slg-3	Emil Wolff GmbH, Essen	20.50	4.92	5.90-6.56		-	10.59-17.65	9,259	2	20	20		17	1.47-2.95	706-883 Cu. ft./b
_	III SHAKER CONVEYORS 1—Duckbill with elevated conveyor 2—Duckbill with gathering chain 3—Mark L4-530 Conveyor	Eickhoff, Bochum Eickhoff, Bochum Mark Brennkraft, Wengern	82.21 41.50 31.17	3.67 3.67 4.92	4.92	3,72	13.12		4,189	===					option	2.190 cu. ft./h 2,190 cu. ft./b
_	1V SWINGING SHOVELS 1 - KSL 3 - KSL 3 - SZR	Bergtechnik, Luenen Bergtechnik, Luenen Bergtechnik, Luenen	\$2.49 32.81 28.87	5.96	6.06 0.98-4.74 3.61-5.25	13.12 8.20 9.84			22.046 11.023 7.716	학이	8 8 Pushing	2X15 15 15		6.5	option option option	2,442 cu. ft./h 1,060 cu. ft./h 1,060 cu. ft./h
-	LOADERS WITH GATHERING 1-Type ZL-60	ARM Geweisenhuette, Luenen	35.27	13.38	7.87	15.74	18.37		24,455	64					1.90-2.46	
-	VI REVOLVING SHOVELS 1—A.C. Pretrosmi 2—UNIO Mi-1 3—PML - 3 4—PML - 5 5—PL - 5 5—PL - 5 5—PL - 5	Romania Romania U.S.S.R. U.S.S.R.	5.90 7.54 7.45	24.25.25 25.25 25.25	5.84 5.84 5.85 5.85 5.85 5.85 5.85 5.85	54 54 55 55 55 55	6.06 6.56 6.56	6.00 6.00 4.24 12.35	4,189 5,070 6,062	PERSONAL PROPERTY.	4.5	10.5	ç		1.31-2.95	1,765 cu. ft./h 1,765 cu. ft./h 706 cu. ft./h 1,765 cu. ft./h 1,060-1,590
	7—LZK 1 - D	Poland	8.62	3,94	7.54		7.21	7.06	6,437	2	1.2	1.2			1.54-2.13	706-2,
	8 Salzgitter HL - 100	Salzgitter, Salzgitter Bad	6.62	3.97	6.30-7.12		88.9	3.53-7.06	5,732	74	90	œ			1,47-2,46	706-
	9-Salzgitter HL-200	Salzgitter, Salzgitter Bad	7.21	4.42	7.05	2.62	06'9	7.06	7,716	2	14	14			1.47-2.95	1,060-2,
	10-Salzgitter HL-300	Salzgitter, Salzgitter Bad 9.51	9.51-10.00	4.50	7.38-8.69		7.21	10.59	12,125	2	14	14			1.50-2.95	2,120-2,
	11—Joy Sullivan HL-3 (three sizes) Joy Mfg. Co. Pittsburgh, 12—Joy Sullivan HL-20 (t%o sizes) EIMCO Corp., Salt Lake 13—EIMCO-21 City Passbendet, Siegmann 15—EIMCO-40	Joy Mfg. Co. Pittsburgh, Pa EIMCO Corp., Salt Lake City Fassbender, Siegmann	6.25 6.70 5.90 6.76 20.70	2.72 4.69 2.33 2.78 5.25 5.25	6.58-712-6.06 7.28-7-84 7.28-7-84 7.15 7.15		6.00-8.00 7.24-10.00 6.60 7.20 12.00	7.41-9.88 7.41-9.88 6.00 9.88 17.12	4,209 7,209 4,189 15,496	enterior of	14.5 9.5.5 18.5	14.5 11.5 18.5	0	9	1.49-2.50 1.97-3.28 1.31-2.95 1.47-3.94 2.46-4.92	1,765 cu. ft./h 2,472 cu. ft./h 4,590 cu. ft./h
	16—Atlas-Diesel LM-30/35 17—Atlas-Diesel LM-30/55 18—Gardner-Denver GD-9 19—Gardner-Denver GD-14	& Co., Dueseldori Atlas-Diesel A.B., Stockholm Atlas-Diesel A.B., Stockholm Machineniabrik Abeien, Bern Machinenfabrik Abeien, Bern	6.56 6.76 6.30 6.90	31.17 3.44 2.70 3.87	7.05 6.56-7.21 6.30-7.28 7.57-8.07		7.21 7.87 6.23-7.74 6.55-7.64	3.88 4 4.59 4 4.24-4.59 4 6.35 5	4,189-4,409 4,630-4,850 4,409-5,534 5,842-6,239	NNNN	0000	10 6 9			from 1.50 up from 1.57 up 1.47-2.59 1.47-3.48	530 cu. ft./b
-	VII DIPPER SHOVELS 1 Westfalia fast loader	Gewerkschaft Eisen-	11.48	4.50	5.23		6.23	4.24	8,818	74	5.1			×	1.74-2.20	883-1,236
	nat**	Myers Whaley Co.,	29.00	5.71	3.38-3.71	3.90	24.05		19,004	1		2.5			from 1.90 up	180-400
		C.S.S.R.	23.10	\$5.00	₹.92					M					crawler	2,442 cu. ft./h
-	VIII EXCAVATOR-TYPE SHOVELS 1-UMP - 1	U.S.S.R.	22.36	5.41	5.00		- 0.84	5.30	18,078	-		27.0			1.97-2.95	1,060-1,412 cu. ft./h
	2-PPM-2	U.S.S.R.	23,79	5.41	7.05		13.12	8.12	18,188	**		27.0		5.7	1.97-2.95	1,060-1,
	3—Conway 20 4—Conway 120 1X MOBILE LOADERS WITH GATHERING ARMS	Goodman Mfg. Co., Chicago, —do— ERING ARMS	26.73	5.27	5.84-8.00	2.50	12.00	7.06	18,519	mi		20			1.49*4.72	32
4	With side continuous chains: 1-8-153 2-MC-3 3-193 18-HR" 4-105 8-BU" 6-FMU-1	U.S.S.R. Mavour & Coulson, Ltd. Joy Mig. Co., Franklin, Pa. do— do— U.S.S.R.	25.50 25.50 25.78 22.11	24.54.88 5.88.5-0 8.88.5-0	3.02-7.21 2.70-4.80 2.92 2.92 2.17 5.58		4. 30		9,347 13,228 28,660 11,023 9,502	H	30,4 0	30.4 or 25 KW	2 N 7	16	crawler crawler crawler crawler	50 t/h 300-600 t/h 90-180 t/h 45 t/h 2,120 cu. ft./h
20	-With side scrapers 7-0-5s 8-Goodman 260 9-Goodman 460 H 10-Jeffrey L,500	U.S.S.R.  -do  -do  -do  -do  Jeffrey Mig. Co. Columbus, Demag. Dusburg	27.72 25.01 26.24 29.59 37.73 9.8	6.00 6.59 6.19 4-16.40	3.94-7.21 5.50 4.82 3.61-7.22		7.23		11,244 28,090 35,053 33,069	( = = = 10	58 58 2 X 6	20	-7	10 P	crawler crawler crawler crawler	240-480 t/P 300-600 t/P 180-560 t/P up to 120 t/P

1. Tons per hour. 2. Cubic feet per hour.

MINING WORLD

The results refer to five slushers operated in 1956 on haulage distances of up to 150 feet. The machines were of Romanian manufacture, built after the models of Soviet slushers LU-15 and B-10, powered by 10.9- and 20 4horsepower motors, respectively. According to official reports, cable breaking during the first weeks was so frequent that the results attained were below the lowest level known. Small capacity scrapers and insufficiently powered hoists hampered haulage of lumps larger than 10 inches. Although up to four loaders were concentrated for service, the slushers' capacity could be used only between 12 and 26 percent due to frequent repair of cables and sliding chutes, of bottlenecks in mine car handling, as well as lack of sufficiently trained manpower. These are the operational results recorded in this experimental slusher operation.

Table No. 11 Average Monthly Efficiency of Slusher Operations at Baia Mare Mine in Roumania

		Cubic	k Fill Yards aced						
36 Foot	15 Foot	36 Foot	15 Foot						
6.5 3.2	14.6 7.3	24.2 12.0	27.3 9.6						
12.5	17.0	23.0	26.0 2 or 3						
manual 2.0	operation: 2.6	2.4	2.1						
	36 Foot 6.5 3.2 12.5 2 manual	Foot Foot  6.5 14.6 3.2 7.3  12.5 17.0 2 manual operation:	Metric Tons         Cubic           Ore Moved         P1           36         15           Foot         Foot           6.5         14.6           3.2         7.3           12.0         23.0           2         2           manual operation:						

Table No. III is a catalog of outstanding types of loading machines built by the world's leading manufacturers. The Soviet Union and Romania —which are understood to specialize in mining machine construction in the Soviet Orbit—are listed with several types of self-propelled loaders. Further East European countries—such as, Czechoslovakia, East Germany, Poland, Hungary, even Bulgaria—are trying to produce their own loading machines that are more often than not versions of Soviet models.

The Soviet Union produces several types of heavy-duty loading machines, such as, revolving shovels, excavatortype shovels, and mobile loaders, with gathering arms. For reasons mentioned earlier, these loading machines are being used, as a rule, in coal mining, and only subsidiarily in metal mining. The clearance dimensions, power, and official performance rating of these machines are listed in Table No. III. Here are some additional notes on their characteristics and behavior, as well as whatever information is available on their actual performances.

Three types of revolving shovels are being mass produced in the Soviet Union: the PLM-3, PLM-5, and the EPM-1. A fourth type, the PL-2 which

is an improved version of the PLM-5, is not yet mass produced. These four loader types are distinguished from similar Western machines more by some construction details than by the underlying principle. All four are suitable for higher profiles (from 80.7 to 106.3 inches) and are powered by two, 4- to 5-cylinder, star-connected electric motors. Power consumption is about one-fifth of that used by air engines performing the same mechanical work (approximately 0.5 kilowatt hour for loading 1.3 cubic yards of broken rock).

The two types of revolving shovels manufactured in Romania are the ACP-Petrosani and the UNION Mi-1 (which, incidentally, looks like a copy of the EIMCO 12-B built by the Eimco Corporation of Salt Lake City, Utah). Both are driven by the same types of motors used to power the Soviet-built PLM-3 and PLM-5.

The high performance listed for the UNIO Mi-1 is, for the time being, a mere theoretical claim. This self-loading machine had to be withdrawn from operation last year because the materials used in its construction had been below specifications, and this caused frequent breakdowns and other accidents. The main complaint was directed against the chains hoisting the dipper that were of sub-standard quality.

The two Romanian machines are suited for exceptionally small working clearances. Most of the other East European countries are concerned chiefly with developing mobile loaders of similarly small dimensions. Their common impediment, however, lies in the insufficient power available for the thrusting and operating mechanisms, as well as the fact wearing-out of the dipper.

The LZK-1-p Rocker Shovel type of Polish manufacture is being used in coal mining but is suitable also for ferrous mining, as well as for surface operation.

In the category of rapid mucking machines, the Soviet Orbit is rather weakly represented. The recent technical literature of this area discusses the "Westfalia" rapid loader, manufactured in West Germany, as an outstanding machine, well-suited for the Orbit's mining conditions, both because of its performance and its small profile (only 75 inches high). Another advantage of "Westfalia" which is being praised by Soviet periodicals is its capacious muck-plate which could accommodate up to three dipperfulls.

The UeKE-3 dipper shovel developed last year by East Germany follows closely in the path of "Westfalia." Its height is only 62.8 inches, and its compactness renders it well-suited for mining conditions in the Soviet Orbit.

### Soviet Machines Like Others

The Soviet-built PM-2 dipper shovel is, truly, lower than "Westfalia," yet twice as long and much larger. It is powered by a single electric motor, and its performance is officially rated at double that of the West German machine. The PM-2 is built on the same principle as the Myers Whaley "Automat." However, according to Soviet sources, it has a short useful life.

There are two, Soviet-built, excavator type shovels of interest: the UMP-1 and the PPM-2. Both are track-mounted, powered by a single electric motor, and are being used mainly for tunnel excavation.

In the category of self-loading machines, the Soviet Union produces three types: the mobile loader with gathering arms S-153 model, the PMU-1, and the O-5s model with side scrapers.

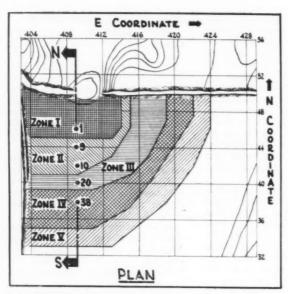
The track-mounted S-153, which is praised as a great achievement of Soviet techniques, has been built mainly for operation in coal mining. It is being used, nonetheless, in non-ferrous mining, particularly in salt mining. Its officially rated performance of 118 cubic yards per hour is, however, only one-eighth of that of its western counterpart, the Joy BU-18.

The PMU-1 has been built for the special purpose of loading in inclined stopes up to 25°. It is a track-mounted machine, powered by three electric motors, and on its chassis are mounted booms for drilling machines. Also the PMU-1 is used mostly in coal mining where its performance has been officially rated at 78 cubic yards per hour. It has been further claimed that during an experimental operation it loaded from a heading advanced 200 feet per month, but no details are known about the geological formation in which it operated.

The O-5s self-loading machine with side scrapers is powered by two 34-horsepower motors and, in spite of its large dimensions, it is relatively light (11,200 pounds). In the Soviet Union, the O-5s is used exclusively in coal mining with a claimed performance of 90 tons per hour. The same machine type is constructed also in Bulgaria where it is used mostly for operation in metal mining.

The officially indicated performances of the Soviet-built mucking machines listed in Table No. IV (last column) are claimed to have been attained in well-organized mine operations. Such operations, are however, the exception rather than the rule, and it stands to reason that their actual performances are below this level.

THE END



PLAN VIEW shows 70 drill holes used to prove up five ore zones. Old tailings discharge was at northwest corner, which led to deposition of coarsest, richest ore in Zone I.

**Drilling.** A two-man crew drilled most of the 70 holes with a hand auger, pulling pipe and pulling and setting casing with a 29T churn drill. Deepest holes went to a little over 50 feet. In general, the holes were placed on corners of a 200 foot square.

Use of Samples. Samples were assayed, checked for gravity (number of cubic feet of inplace ore per long ton), and then were used in laboratory metallurgical tests.

## How Jones & Laughlin Drilled, Sampled, and Calculated Tonnage of Hill-Annex Tailings

During 33 years of operation Interstate Iron Company deposited about 18,000,000 tons of wash iron tailing in a 200 acre pond at Calumet, Minnesota. The December 1957 issue of MINING WORLD described how J&L dredged this tailing and recovered shipping grade concentrates by spirals and flotation. After drilling and sampling the tailing pond here's how the tonnage was calculated.

Method of Calculating Tonnages: The row of holes in Section S-N has a horizontal east-west width of influence of 200-feet (see shaded area on plan view). On the vertical section (below) each hole was assigned an area of influence in accordance with Iron Range practice of assigning rectangular and trian-

gular areas for ease of calculation. Zones grade from richest (Zone I) to leanest (Zone V).

Zone I.

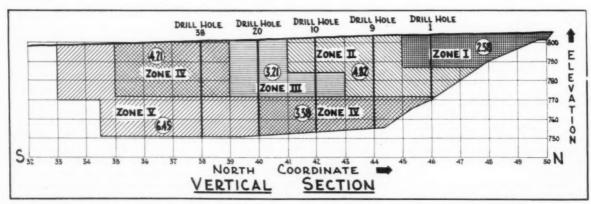
$$\frac{2.58^a \times 133^b \times 20^c \times 200^4}{17.4^c} = 78,883 \text{ tons of crude}.$$

a. Square inches of area planimetered from vertical section.

b. Feet per inch horizontally in vertical section.c. Feet per inch vertically in vertical section.

d. Width of influence of line of holes (plan view).

e. Cubic feet per long ton determined by laboratory tests.



VERTICAL SECTION S-N looks west, shows five drill holes and the block of ore they proved. Circled number in each zone

indicates number of square inches of area on the original drawing. Vertical scale is exaggerated.

### Pb-Zn-Cu: How Flotation's Most Difficult Separation Is Being Done

By FRANK W. McQUISTON, JR.

Flotation of copper-lead-zinc ores presents one of the most complicated problems in base-metal metallurgy. The problem is even more difficult when the copper, lead, and zinc content is sufficient to justify concentration into three separate products. These ores are justly referred to as complex.

Flotation problems in general are of geological origin. The characteristics of an ore deposit have a controlling influence on metallurgical practice. Any alteration on mineral surfaces is of greatest importance because flotation is a surface phenomenon.

Selective flotation of sulphide leadzinc ores has been standard practice for many years. Unfortunately, this practice is not too often applicable to copper-zinc ores due to the similar floatability of copper and zinc minerals. This is especially true when oxidation has caused dissolution of some of the copper. Bulk flotation, followed by separation of the copper from the zinc, is commonly employed. Selective flotation in three steps was an early practice on copper-lead-zinc ores. This practice is seldom used now as the preferred technique is to selectively float a bulk copper-lead concentrate with depression of zinc and iron followed by reflotation of the copper-lead tailing for selective recovery of zinc from iron and other minerals. Separation of the copper and lead from the bulk concentrate is usually accomplished by one of three processes generally referred to as the cyanide, the sulphur dioxide, and the dichromate methods.

Lead-zinc deposits are quite widespread in the world and copper-zinc deposits are fairly common; however, large deposits containing the three metals are relatively rare. A description of the copper-lead separation flotation methods and results of several mining operations concerned with milling copper-lead-zinc ores follows. The mining companies conducting three metal separations are: Buchans Mining Company, Newfoundland, Canada; Idarado Mining Company,



MIXED OXIDES AND SULPHIDES complicates metallurgy at Tsumeb Corporation Limited, South West Africa. Bulk concentrate containing cerrusite is floated first and then galena is depressed with copper floated to cut down reagent cost.

Colorado, United States; and San Francisco Mines of Mexico Limited, the Fresnillo Company, the Parral and Santa Barbara units of American Smelting & Refining Company, all in Mexico; Cerro de Pasco Corporation, Peru, South America; Tsumeb Corporation Limited, South West Africa.

### **Order of Complexity**

Since there are several types of copper-lead-zinc ore deposits with many different mineral associations and characteristics, an order of metallurgical complexity would be as follows:

1. Unaltered sulphide ore comprised of coarse free chalcopyrite, galena, and sphalerite occurring at Idarado, Colorado, and in the Chihuahua, Mexico district.

2. Unaltered sulphide ores containing several types of copper minerals,

galena, and sphalerite found at Buchans, Newfoundland and Cerro de Pasco, Peru.

3. Altered and oxidized ores, where the galena and sphalerite are tarnished or coated, resulting in a more complicated behavior in flotation. Ores in the lower mine levels of Tsumeb, South West Africa, are in this class.

The above ore types become more complex in those cases where pyrite or marcasite are also present, where marmatite occurs in place of sphalerite, and when the minerals are finely disseminated or interlocked.

Each of the above mining operations employs a technique of copperlead separation tailored to fit the particular type of ore and metallurgical problem involved. The following summarizes the methods of separation used and results obtained.

### **Buchans Practice**

Buchans ore is a complex fine grained mixture of chalcopyrite, galena, gold, silver, pyrite, and sphalerite with minor amounts of bornite, tetrahedrite, tennantite, cobaltite, and hematite. The principal gangue minerals are barite, quartz, and calcite.

The Buchans practice of using sulphur dioxide gas in decoppering the copper-lead concentrates was developed in 1936 and has been in constant use since that time. In this practice the bulk copper-lead concentrate is pumped at about 35 percent solids to an SO<sub>2</sub> gas tower. Discharge from the tower is conditioned with sodium bichromate for approximately 20 minutes for lead depression. Lime is used to adjust the pH to 5.0 for copper flotation.



FRANK W. McOUISTON, IR.

Mr. McQuiston is chief metallurgist for Newmont Mining Corporation with headquarters at 300 Park Avenue, New York, New York. This discussion was presented by Mr. Mc-Quiston at the International Mineral Dressing Congress in Stockholm, Sweden. Reagent consumption per ton of bulk concentrate is around 1.5 to 2.0 pounds of sulphur dioxide and 3.0 to 5.0 pounds of sodium bichromate. An example of results obtained by this reagent combination is as follows:

	Ass	ay, per	cent	Distrit	bution,	percent
Bulk con-	Cu	Pb	Zn	Cu	Pb	Zn
centrate	8.0	39.0	13.0	100.0	100.0	100.0
Copper coa- centrate	21.0	8.0	10.0	92.0	7.0	26.0
Lead con- centrate	1.0	56.0	15.0	8.0	93.0	74.0

A semi-bulk float produces a rougher copper-lead concentrate high in sphalerite and pyrite. Selectivity is obtained after four to five cleaning stages in which evanide is used.

Idarado ore occurs in quartz veins with sulphide mineralization comprised of coarse unaltered chalcopyrite, galena, sphalerite, and pyrite associated with gold and silver. Cyanide is used for separation of copper and lead. This method was found particularly amenable to separation of untarnished chalcopyrite and galena from a bulk concentrate when the lead to copper ratio is less than 2:1.

Chalcopyrite is equally as well depressed with a reagent comprised of a complexed cyanide compound as with the straight calcium or sodium evanide salt. Straight cyanide has the disadvantage of dissolving free gold contained in the bulk concentrate. In addition to gold dissolution, soluble copper losses run as high as 0.7 pound per ton of solution. These losses amount to several ounces of gold and several hundred pounds of copper per day. Dissolution of gold and copper can be almost entirely eliminated when the cyanide is added to a reagent which is previously complexed to a zinc-cyanide compound.

The most effective compound for chalcopyrite depression is a mixture

of zinc oxide and cyanide. Zinc sulphate may be substituted for the oxide providing the sulphate is neutralized with lime to assure protective alkalinity for the cyanide. American Cyanamid reagent 675, a reaction product of zinc oxide, hydrocyanic gas, and ammonia, is a good copper depressant and can be used as a substitute for cyanide.

Consumption of straight cyanide, zinc-cyanide compound, or American Cyanamid 675 for copper depression is largely dependent upon the copper content of the bulk concentrate. As a general rule each unit of copper contained in the bulk concentrate will require about 0.50 pound of equivalent NaCN per ton of concentrate when a straight cyanide salt is used. If a zinc-cyanide compound is used, approximately 0.50 pound per ton will also be required, corresponding to only 0.20 to 0.30 pound of equivalent NaCN per ton. The cost of using straight NaCN compared with a zincevanide compound is about equal.

At Idarado the reagent consumption on a bulk concentrate assaying 12 per cent Cu is about 6.0 pounds per ton of either NaCN or the zinccyanide compound. On a concentrate assaying 16 percent Cu consumption would be approximately 8.0 pounds. Typical results when using either reagent are as follows:

	Assa	y, peri	cent	Distrib	bution.	percent
	Cu	Pb	Zn	Cu	Pb	Zn
Bulk con- centrate	13,7	35.2	4.7	100.0	100.0	100.0
Copper con- centrate	25.2	3.4	6.1	90.0	4.6	65.0
Lead con-	2.2	86.1	2.7	10.0	05.4	25.0

San Francisco Mines of Mexico developed, many years ago, a sulphurous acid technique for separation of chalcopyrite and galena. The present practice is to add sulphurous acid so-

lution directly to the bulk copper-lead concentrate. The only conditioning used is through pumping the concentrate to the separation flotation machine. Boiled starch is added with the sulphurous acid to obtain lead depression. The pH is held to about 6.0. Starch is also added to the separation roughers and cleaners.

The Fresnillo practice on a similar type of bulk concentrate is to pump the concentrate to the top of an SO<sub>2</sub> tower and allow it to percolate down through the gas and acid. Consumption of reagents per ton of bulk copper-lead concentrate treated is approximately 4.0 pounds of sulphur and 0.6 pounds of corn starch. Typical separation results when using this technique will be approximately:

	Arre	y, per	cost	Distril	bution, 1	bercent
	Csc	Pb	Zn	Cu	Ph.	Zn
Bulk con- centrate	4.6	55.0	6.8	100.0	100.0	100.0
Copper con- centrate	26.0	8.2	5.0	70.0	2.0	10.0
Lead con- centrate	1.5	62.0	7.0	30.0	98.0	90.0

#### Cerro de Pasco's Varied Ores

Cerro de Pasco has done an extensive amount of laboratory, pilot testing, and plant experimental work on various copper-lead separation methods. The different copper mineralizations in several types of complex ores in this mining district made it imperative to investigate various separation schemes, resulting in the adoption of the dichromate method at one concentrator, and the cyanide method at another.

The Casapalca ore comprises tetrahedrite, tennantite, enargite, chalcocite, and covellite associated with galena, sphalerite, and pyrite in a gangue of quartz, calcite, and rhodochrosite. The copper-lead-zinc ratio in the concentrator feed is approximately 1:5:8. Dichromate is used on the conper-lead bulk concentrate produced from this ore. Separation of the cleaned concentrate is made at a pH of 8.0 in a low temperature solution. Conditioning has proved to be detrimental to the separation. The dichromate consumption is approximately 3.5 pounds per ton of concentrate fed to the separation circuit. Separation results are as follows:

	4.0	say,	Distril	bution,
	pere	ent	pere	ent
	Cu	Pb	Си	Pb
Bulk concentrate	7.0	50.0	100.0	100.0
Copper concentrate	26.0	7.2	95.0	17.0
Lead concentrate	3.0	63.5	5.0	83.0

The Mahr Tunnel ore from San Cristobal district contains chalcopyrite as the predominant copper mineral with minor amounts of chalcocite, covellite, bornite, tetrahedrite, and tennantite. The copper minerals are associated with galena, sphalerite, and



ROUGHER CIRCUIT SEPARATION of copper-lead-zinc is made at Lake George Mines Limited in Australia. Zinc is depressed during copper flotation then cyanide depresses zinc for galena flotation in this three stage circuit.

pyrite and the gangue is chiefly quartz and siderite. The copper-lead-zinc ratio in the ore is about 1:3:8. The bulk copper-lead concentrate is conditioned for a short time ahead of flotation with approximately 10 pounds of NaCN per ton of separation feed with enough starch to obtain dispersion. Typical results are as follows:

	As	ay.	Distril	oution.
	per	cent	pere	ent
	(11	10	Cu	Pb
Bulk concentrate	9.0	46.0	100.0	100.0
Copper conceatrate	20.0	7.5	85.0	35.0
Lead concentrate	6.0	60.0	15.0	65.0

The ore minerals are finely disseminated with considerable intergrowth which accounts for low lead recovery. Dichromate was found to be ineffective as a lead depressant.

At both Casapalca and Mahr Tunnel, the main objective is to produce a lead concentrate suitable for subsequent metallurgical treatment at some sacrifice of recovery which accounts for the copper recovery being higher than the lead recovery. When the zinc content in the bulk copper-lead concentrate becomes very high, separation of the copper and lead is quite difficult.

### **Reagent Combinations at Tsumeb**

Tsumeb did extensive laboratory research and pilot plant experimental work on a copper-lead separation of a bulk sulphide concentrate. Tennantite, the major copper mineral was associated with minor amounts of bornite, chalcocite, and chalcopyrite. The ammoniacal zinc-cyanide compound, American Cyanamid reagent 675, was reported to give superior results to straight cyanide. Dichromate failed completely to make a separation and sulphurous acid gave inferior results because of the presence of bornite.

Consumption of reagent 675 was approximately 6 pounds per ton of bulk concentrate fed to separation. Metallurgical results were as follows:

	Ass	ay, per	reent	Distril	bution,	percent
	Cu	Ph	Zn	Cie	Pb	Zn
Bulk con- centrate	10.0	55.0	6.0	100.0	100.0	100.0
Copper con centrate	31.0	4.0	12.0	80.0	2.0	80.0
Lead con-	3.0	22.0	4.0	20.0	08.0	20.0

The Tsumeb ore body, at a depth of 2,800 feet and below a zone of 1,000 feet of true sulphide ore, is partially oxidized. Sulphide minerals are in various stages of alteration with approximately 15 percent of the copper content and 25 percent of the lead occurring as oxides. The sphalerite is highly activated and cannot be depressed for selective flotation of copper and lead: therefore, the copper lead-zinc sulphides are floated into a single bulk concentrate, along with an appreciable amount of cerrusite that

has become activated. The sulphide minerals do not exhibit their usual flotation characteristics because of surface tarnishing and coatings.

Two different reagent combinations were developed in the laboratory for copper-lead separation of a bulk concentrate containing about 30 percent copper and 20 percent lead derived from this partially oxidized ore. In one scheme the copper minerals are depressed with American Cyanamid reagent 675 and in the other galena is depressed with large quantities of lime. Chalcocite does not respond to cyanide, whereas in the high lime circuit bornite tends to be depressed with the galena. Depression of galena and flotation of copper appears to be the most practical method due to the high cyanide consumption required to depress the large volume of copper.

An interesting feature of Tsumeb metallurgical practice was the development of a method for the separation of copper and lead from zinc in a bulk concentrate containing all three metals. In this method the zinc was floated and the copper-lead minerals were depressed with American Cyanamid reagent 610 in combination with dichromate. This separation was only effective on sulphides recovered from ores that had undergone substantial oxidation. Surface alteration rendered the copper and lead sulphides less floatable than the highly activated sphalerite.

Lake George Mines, Australia, make a copper-lead-zinc separation in the rougher circuit by three stages of selective flotation on an ore comprising chalcopyrite, galena, sphalerite, and pyrite. Sulphur dioxide is added in the grinding circuit to give a pH of 6.8 for zinc depression during copper flotation. Galena is then floated in the presence of cyanide used for zinc depression. The copper concentrate assays

approximately 24.1 percent copper, 5.5 percent lead, and 4.7 percent zinc with a 76 percent recovery of the copper. The lead concentrate assays 2.0 percent copper and 57.2 percent lead and 11.6 percent zinc with a recovery of 80.7 percent of the lead.

Sunshine Mining Company in Idaho, separates tetrahedrite from galena with a combination of sodium sulphite and zinc sulphate. Reagent consumption is about 10 pounds of each reagent per ton of bulk concentrate for galena depression.

There are many other interesting and noteworthy separations of copper and zinc, copper and molybdenum, and zinc and pyrite. At Union Minière's Kipushi operation in the Belgian Congo, a copper-zinc separation is made on a difficult bornite, chalcopyrite, sphalerite ore with sodium ferrocyanide. Methods for copper depression in copper-molybdenum separations include low temperature roasting, steaming of concentrates, use of phosphorous pentasulphide, and sodium ferrocyanide with polysulphide.

### **Method Fits Ore**

It is reasonable to assume that each separation technique employed by different mining companies was tailored to fit their particular ore characteristics. The data available from laboratory investigations and plant practices seem to indicate a relationship between the effectiveness of selected flotation methods and certain types of bulk concentrates.

Straight cyanide and also zinc-cyanide compounds are excellent depressants of chalcopyrite, bornite, tennantite, and other copper minerals but are ineffective on chalcocite and covellite. Sulphurous acid in combination with starch or dichromate is a good galena depressant. This raises the issue of why Idarado uses the cyanide compounds.



SULPHOROUS ACID SOLUTION has been used for many years to separate chalcopyrite and galena at the San Francisco Mines of Mexico Limited in Mexico. Lead is depressed by the addition of boiled starch at three places in the circuit.

nide method and San Francisco del Oro the sulphurous acid method for the separation of chalcopyrite and galena. Perhaps the reason may be in the lead to copper mineral ratio which at Idarado is 1:1 and at San Francisco 5:1. The best separation at Idarado is made with a lead to copper ratio of less than 1:1. With a ratio higher than 2:1 the separation is not nearly so efficient. It is usually better practice to float the least amount of material, which, in the case of San Francisco, is the copper mineral. Buchans adopted the use of sulphurous with a 2:1 lead to copper ratio; however, they also have copper minerals other than chalcopyrite.

The zinc content in the bulk concentrate probably exerts considerable influence on the method of separation selected. Zinc minerals are fairly well depressed with cyanide and therefore, report with the copper. However, sulphur dioxide is also a depressant for sphalerite and in this method of separation will report with the lead. In line with the above comparison of lead to copper ratios, this means in effect that sphalerite has a tendency to follow the copper minerals when cyanide is used and the galena when sulphur dioxide is the separation reagent.

The following indicates the influence the lead to copper ratio may have on the separation technique selected.

Mine	Maior-copper mineraliza- tion	Method of separation	Approximate lead: copper mineral ratio
Buchans Idarado San Francisco	Chalcopyrite Chalcopyrite Chalcopyrite	Cyanide	2:1 1:1 5:1
Casapalca Mahr	Diversified Chalcopyrite	SO <sub>2</sub>	4:1
Tsumeb	Tennantite	Cyanide	2:1

The lead-to-copper ratio at Mahr and Tsumeb would indicate that perhaps a separation could also be made with sulphur dioxide as well as with cyanide. However, both of these concentrates contain bornite, which is oftentimes difficult to float in a sulphurous acid circuit.

The use of sulphur dioxide to produce sulphurous acid probably serves a dual purpose. It is generally accepted that the acid has some activation properties for copper minerals by cleaning the surface of oxidation tarnish and secondly by acidifying the pulp to allow the chromate to inhibit lead flotation. Sulphurous acid is used in the primary rougher float at Buchans and also Lake George for sphalerite depression. When used in conjunction with either starch or chromate, it is sometimes as efficient for zinc depressant as cyanide. The presence of bornite is reported to seriously unbalance a sulphur dioxide separation. The bornite floats readily in the first separation rougher step but has a tendency to be depressed when recirculated, thereby contaminating the lead concentrate.

When a bulk concentrate contains galena in combination with partially altered lead minerals which do not float readily, a sulphur dioxide method would probably make a better separation than cyanide. The tarnished galena and altered lead minerals are reluctant to float and have a tendency to report into the separation tailing with either the copper or lead, whichever is depressed.

In a cyanide separation of lead flotation and copper depression, the cyanide ion concentration appears to be an important function regardless of whether the cyanide is added as a zinc-cyanide compound or is complexed with metal ions of iron or copper in the pulp solution.

### Can You Make Bulk Float?

The success of any separation technique starts with the flotation practice employed in the bulk copper-lead rougher flotation. A high degree of selectivity must be achieved in the rougher float or the sphalerite and pyrite become over promoted and will report in the bulk concentrate, thereby unbalancing the lead-copper ratio. Also if the copper or lead minerals are highly activated, the separation will be difficult.

Chalcopyrite, sphalerite, and pyrite have about the same flotation characteristics; therefore, selective flotation of chalcopyrite with rejection of sphalerite and pyrite requires knife-edge reagent control. At the Idarado concentrator, cyanide is used for zinc and iron depression, but stringent control must be exercised as the chalcopyrite is sensitive to cyanide in amounts of 0.01 pound per ton above the required quantity. The collector reagent tolerance for galena and chalcopyrite promotion is of the order of 0.005 pound per ton.

It is improbable the behavior of copper and lead minerals comprising a bulk concentrate will conform exactly to prediction during reflotation in a separation circuit. There is, however, a certain pattern that may be expected. Cvanide has no depressing effect on galena, almost none on chalcocite, and little on covellite. Cyanide and zinc-cyanide compounds are excellent depressants for chalcopyrite, bornite, tennantite, and usually for tetrahedrite, enargite and some other less common copper minerals. Sulphurous acid in combination with starch or chromate is a galena depressant.

### **Cyanide Important**

Separation results indicate that cyanide is the most effective when the

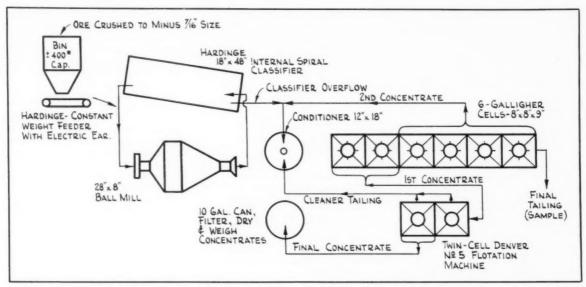
lead-to-copper mineral ratio is about equal. A high lead to copper ratio causes copper losses through intrapment in the large volume of the lead flotation froth. Excessive froth cleaning steps results in the fine galena sizes dropping out and into the copper. A bulk concentrate containing appreciably more copper than lead can probably be separated by depression of the lead rather than the copper because the high cyanide consumption results in a high cost separation.

Factors considered important in normal flotation practice have a magnified influence on separation results. Mineral particle size has considerable effect on metallurgical results. In a cyanide separation the slimed galena has a tendency to drop out of the froth and into the copper when several cleaning steps are used. Particles coarser than 100 mesh are more difficult to control than the finer nonslimed sizes. Froth crowding and depth of froth column must be more carefully regulated than in the average flotation practice where the flotation differential between separate minerals or the gangue is sharper. Flotation machine dimensions required for a separation are closely related to the volume of bulk concentrate pulp, froth area for draining, and weir length for crowding action. A low pulp density at below room temperature sometimes aids a separation. Freshly produced concentrates taken directly from the cleaner cells to the separation circuit generally respond more favorably than concentrates that have been aged by thickening or conditioning for a long period of time.

Practice has indicated that cyanide and zine-evanide compounds will make an efficient metallurgical separation of copper from lead on selected types of bulk concentrates. Concentrates not considered amenable are those containing the following: substantial quantities of chalcocite or covellite; high ratio of copper to lead; appreciable amounts of tarnished or oxidized galena. With these restrictions on the cyanide method it can be concluded that the sulphur dioxide method would have the widest application for the flotation separation of copper from lead in a concentrate produced from a complex copper-lead-zinc ore.

The advancement of flotation technology in mineral separations of a bulk concentrate has demonstrated a practice that should chart a future route to follow in flotation of complex ores. The smaller quantities of bulk concentrate allows for the use of techniques that cannot be economically practiced on the total ore stream.

THE END



FLOWSHEET OF CONTINUOUS pilot plant flotation test on Hermes mercury ore at Mining Experimental Station of Washington State Institute of Technology, Pullman, Washington, Capacity of circuit is 125 pounds per hour.

### Holly Minerals' New Three-Step Process For Impure Mercury Ores

### By: Ernest Oberbillig, James Fyfe, William Aitkenhead, and John Jaekel

Furnace treatment of most mercury ores yields high recovery with a moderate cost; the impure quicksilver ores containing arsenic and antimony, however, cause condenser and "cleanup" problems. These condenser difficulties frequently lower recovery below 90 percent and raise costs several dollars per ton of ore treated. The results of an improved method to treat these "impure" mercury ores are described in this article. The process consists of three separate and distinct operations: first, crushing, grinding, and flotation concentration; second, leaching concentrates with sodium sulphide to produce the water-soluble double salt, HgS Na S; and third, the electrolytic precipitation of the mercury from the alkaline sulphide solution.

An additional leaching step to remove arsenic is also described and results given.

Messrs Oberbillig and Fyfe are consulting engineers for Holly Minerals Corporation, Yellow Pine, Idaho. Dr. Aitkenhead and Mr. Jaekel are, respectively, directors and metallurgist, Mining Experiment Station, Washington State College, Pullman, Washington. The purpose of this study was to determine if flotation and leaching could be applied to the mixed cinnabar-arsenic ore from Holly Mineral Corporation's Hermes mine in Valley County, Idaho. Heretofore, arsenic in the ore caused troubles in retorting and condensation of Hermes ore. The 120-ton rotary furnace plant at the Hermes was destroyed by fire in Au-

Table No. I (a)
Flotation Results on Hermes Mercury
Ore at Nevada Mercury Corporation's
Mill near Lovelock, Nevada

Product	Tons	Pounds Hg Per Ton	Assays Per- cent As Per Ton	Mer- cury Dis- tribu- tion Per- cent
Head	17,100	5.5		100.0
Concentrate	0.149	597.0	8.7	94.7
Tailing	16.951	0.3	-	5.3

Table No. I (b)
Reagents Used in Hermes Mill Scale
Flotation Test

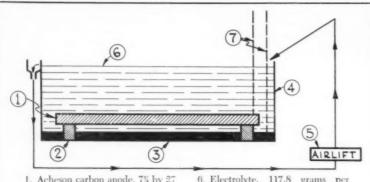
Reagent	Pound Per Ton	Where Added
Pb(NOs)2	0.5	Ball mill
301	0.4	0.3 to conditioner 0.1 to No. 2 flotation cell
Frother 65	0.1	To No. 2 flotation cell

gust 1956. Rather than replace the furnace plant immediately, it was decided to test this new method of mercury reduction and if the process proved successful to install it in place of a new furnace plant.

Meanwhile, an affiliated company, the United Mercury Mines Company (an Idaho Corporation) started milling cinnabar ore from the Vermillion mine which is about one mile southeast of the Hermes mine in Valley County, Idaho. The ore is trucked to United's mill at Yellow Pine and treated in a standard flotation plant. Concentrates are retorted. Recovery is above 90 percent and concentrates average higher than 55 percent mercury. Reagents are copper sulphate, Z-11 xanthate, and Dowfroth 250.

#### Flotation Methods To Date

Gaudin, in his 1932 book, "Flotation," reported some mercury ores were amenable to flotation with high recoveries and concentrate grades. It is interesting to note that prior to Gaudin's work, the New Zealand Journal of Science and Technology in 1921 included a publication notable for its advanced treatment of the subject. This publication, "Thornhill's Sodium-Sulphide Process for the Recovery of Mercury, as Applied to



- Acheson carbon anode, 71 by 27 by 1½ (thick) inches.
- Four glass insulator stools. 3. Mercury pool cathode, 10.28 kilograms of mercury.
- 4. Electrolytic cell built of 332-inch welded steel plate, 9-inches wide by 30-inches long, by 17inches deep.
- 5. Airlift, 3-inch diameter leg and %-inch glass tubing.
- Electrolyte, 117.8 grams per liter of mercury and 25 percent Na<sub>2</sub>S + NaOH (4 to 1) with a specific gravity of 1.270.
   Power, rectified current, 1.60 volts, 0.3 amperes per square inch. 1.1 kilowatt hours per pound of mercury produced (cost 1.0 to 1.5 cents per pound of mercury) of mercury).

ELECTROLYTIC CELL (Figure No. 2) Used for Holly Mineral's mercury test.

Cinnabar-Ore from Puhipuhi" by W. Donovan,1 somehow eluded the American writers of mercury metallurgy. Reference to this work is, however, listed in the chemical abstracts.

In this current study we continued the pioneer work of Mr. Donovan. The flotation results of that experimenter using ordinarily non-selective reagents are equivalent to modernday practice with xanthate collectors. He records 85 to 90 percent recovery, and 30 percent mercury concentrates from ore assaying 1.42 percent mercury.

A flotation study of mercury ores by Fahrenwald, Newton, and Shaffer from the University of Idaho casts new light on the subject of cinnabar flotation and its separation from arsenic and antimony minerals.

To our knowledge, the first reported (1941) plant to use flotation for the recovery of cinnabar (the mercury sulphide mineral, HgS) was Compania Mercurio en Sain Alto and Beneficiadora de Mercurio, S.A.2 at Sain Alto, Zacatecas, Mexico. This was a 50-tonper-day, single-circuit, flotation mill. Retort reduction of the flotation concentrates produced metallic mercury.

Flotation described by Segura<sup>3</sup> was also used at that time (1941) to pro(Sb<sub>2</sub>S<sub>3</sub>·HgS). This antimony-mercury sulphide concentrate was shipped to El Segundo, California, where it was retorted and smelted into clean, marketable antimony and mercury metals. H. B. Menardi reports this process.

An interesting flotation separation of mercury and arsenic minerals was disclosed by Rev and Brevers.4 We attempted, without success, to duplicate their results with the Hermes ore. No explanation can be given for this, but a discussion of their paper lists another worker who was unable to duplicate their results.5 We suspect different ores as the reason.

Recently, R. R. Wells of the U. S. Bureau of Mines has been concerned with mercury ore flotation and one paper reports his findings. Also, a later paper<sup>6</sup> relates further study.

Today, three plants in Nevada and Oregon use flotation and retort reduction of the mercury sulphide concentrate. Keith Kunze summarizes these Nevada operations in the September 1957 issue of MINING WORLD.

Cinnabar flotation does not always vield good recovery and concentrate grades, however; some types of opal ore have the cinnabar very finely disseminated. Naturally, such an opal type of ore could not be commercially treated by flotation.

Before the test work described here. 17 tons of the Hermes ore were trucked to the Nevada Mercury Corporation plant near Lovelock, Nevada. This ore shipment was milled with results reported in Table No. I, (a) and

Pilot Plant Ore Test

### duce a Livingstonite concentrate

The ore tested was from the Hermes mine and contains the mercury values almost wholly in the form of cinnabar. A trace of native mercury is observed at times. The gangue minerals consist of silicified limestone and some quartzite. Also, considerable clay and hematite are present in the ore. Other sulphides noted were: arsenopyrite, pyrite, realgar, orpiment, and a small amount of stibnite. The four-ton sample assayed 0.41 percent mercury and 0.34 percent arsenic.

The flowsheet and equipment used in this test are shown in the flowsheet. This pilot plant is located at the Washington State Institute of Technology, Mining Experiment Station, Pullman,

Washington.

The ore was sticky and wet when received, making it necessary to dry it for several days on a concrete floor in a heated room. After the ore was dry (2.0 percent moisture), no difficulty was experienced in crushing it to minus 7/16 inch size. The ore was stored in 50-gallon, open-top, drums to be shoveled into a charging bucket

Table No. II (a) Pilot Plant Tests on Hermes Mercury Ore at Washington State College

Product	Tons	Percent Mercury	Percent Arsenic	Percent i	Recovery Arsenic
Head	3.94000	0.410	0.34	100.0	100.0
Concentrate	0.0325	46.800	2,35	94.2	5.7
Tailing	3.9075	0.0242	0.32	5.8	94.3

### Table No. II (b) Flotation Reagents Used in Pilot Plant

Date	Bail Mill	Conditioner	Rougher 1 & 2	Rougher 3	Rougher 5	Cleaner 1
March 18	610-0.178,4	CuSO <sub>4</sub> -0.96 301-0.13 <sup>5</sup>	F65-0.04 <sup>6</sup>	F65-0.01		
19		CuSO <sub>4</sub> -1.20 301-0.03	F65-0.04	F65-0.01	_	NaCN-0.01 610-0.16
20		CuSO <sub>4</sub> -1.46 301-0.06	F65-0.04	F65-0.01		NaCN-0.01 610-0.16
21	NaCN-0.10	CuSO <sub>4</sub> -1.32 301-0.06	F65-0.04	F65-0.01	- Aller Annual A	NaCN-0.05 610-0.16
22	NaCN-0.06	CuSO <sub>4</sub> -1.07 301-0.06	F65-0.02	F65-0.01	301-0.04	NaCN-0.02 610-0.16
2.3	NaCN-0.06 CaO-pH 9.0	301-0.09	F65-0.02	F65-0.01	301-0.04	NaCN-0.06 610-0.24

This shows overall results, 2. Samples and assays were taken of each day's run, 3. In pounds per ton
of feed. 4. American Cyanamid depressant. 5. American Cyanamid collector. 6. American Cyanamid frother.

which was hoisted and dumped into the pilot plant bin as milled. Results of this pilot plant flotation test of the four-ton sample are given in Table No. II, (a) and (b). The test was made by operating the pilot plant an average of 10 hours per day for six consecutive days. It should be noted here that with or without copper sulphate (see reagents for March 23) the flotation recovery and concentrate grade varied but little.

Activation with copper or lead salts does not appear necessary for cinnibar in some ores but in others is essential for good recovery. Slimes do not appear to cause difficulty in the flotation of the Hermes ore.

The results of the flotation of this ore in the pilot plant confirmed careful batch tests. The mill test at the Nevada Mercury Corporation plant also showed flotation to be a successful treatment step for the Hermes ore. Pilot plant recovery was 94 2 percent with concentrates assaying 46.8 percent mercury.

#### **Arsenic Leach Tests**

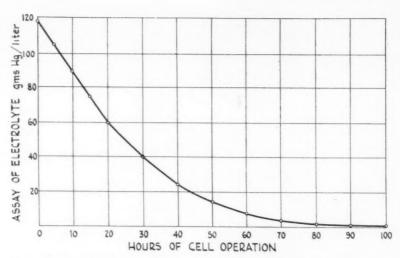
Before leaching of the cinnabar flotation concentrates with the sodium sulphide, we believed it possible (from batch tests) to dissolve the orpiment and realgar (arsenic sulphides) with a weak solution of caustic. The arsenic dissolved and carried into the sodium sulphide solution will either foul the electrolyte or the deposited mercury. It was also found that arsenopyrite was not dissolved with either caustic or sodium sulphide so it passed into the leach residue. It was further disclosed by tests that weak caustic did not dissalve any appreciable amount of cinnabar. The concentrates from the flotation test assayed 46.80 percent Hg and 2.35 percent As. This calculates better than a 95 percent rejection of arsenic in the flotation tailing and leaves the leaching step with only a small remaining amount of arsenic to remove. Table No. III summarizes the results of the arsenic leach tests.

These results show that the "soluble arsenic" minerals can be effectively removed from the concentrates by means of an inexpensive caustic leach without an appreciable mercury loss.

Batch tests with pure stibnite mineral showed that the mild caustic leach will remove most of the antimony.

#### **Mercury Leach Tests**

Dissolution of mercuric sulphide with sodium sulphide solutions was first reported by Volhard in 1878. Thornhill applied this method to the treatment of an amalgamation tailing



ELECTROLYSIS CURVE of alkaline-mercury solution using 1.6 volts and current density of 0.3 ampere per square inch. (Figure No. 2) This curve was plotted from pilot plant data at Washington State Institute of Technology.

for the recovery of mercury in the form of artificial cinnabar. This early work by Thornhill resulted in a leaching process which produced about 800 flasks of quicksilver. Thornhill used solutions containing 4.0 percent Na<sub>2</sub>S and 1.0 percent NaOH. Likewise, Donovan used the same solution strengths in his work.

We believe the chemical equation for dissolution of mercury sulphide (cinnabar) to be:

An increase in temperature is said to drive the reaction to the left; also excessive (20 to 1) dilution of the double salt solution causes precipitation of mercury sulphide.

A similar process has been described for the extraction of antimony by Church Holmes. This process removes antimony from silver concentrates at the Sunshine Mining Company's mill at Kellogg, Idaho.

To treat a flotation concentrate of cinnabar assaying about 50 percent mercury, a large volume of 4.0 percent sodium sulphide solution would be required. This would entail large tank and precipitation equipment so we used 25 percent Na<sub>o</sub>S + NaOH

solutions to lower installation costs of a possible plant. An increased solubility of the mercuric sulphide can be attained by the addition of NaOH in the ratio of 4 to 1 (Na<sub>2</sub>S to NaOH), according to Donovan.

Table No. IV shows the results of cinnabar leaching with the sodium sulphide-sodium hydroxide solution. Final extraction was better than 99 percent of the mercury in the concentrates. The pregnant solution had a specific gravity of 1.270 and contained an average of 114.0 grams per liter of mercury. This solution had a light amber color. It was stored in 20-liter stoppered glass jugs until used in the electrolysis experiments. Different jugs had varying mercury assays due to wash solutions. Filtering offered no trouble but could be facilitated by one of the new filter aids.

### **Electrolytic Precipitation**

Electrolysis was used by Donovan to recover mercury from the doublesalt caustic solution.

Small-scale beaker electrolytic tests by us proved successful and showed mercury could be economically stripped from the solutions.

Table No. III
Results of Caustic Leach of Mercury Flotation Concentrate for Arsenic Removal

	Test No. 1	Test No. 2
Solvent, pounds	200.0	200.0
Solvent, percent NaOH	2.5	2.0
Concentrate, pounds	30.00	32.75
Concentrate, percent As		
Concentrate, percent Hg	46.80	46.80
Agitation time, hours	21	18.5
Final residue, percent Asi	0.85	0.81
Final leach liquor, milligrams Hg per liter	1.0	Trace
Machine used: Motor driven agitator in stainless steel kettle.		

<sup>1.</sup> Microscopic examination shows the arsenic to be largely arsenopyrite in the leach residue.



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#### Table No. IV

### Results of Leaching Concentrate With Sodium Sulphide For Mercury Recovery

Solvent	20 percent Na <sub>2</sub> S + 5 percent NaOH
Quantity, solvent	30 pounds Na_S and 715 pounds NaOH
Machine	50 gallon stainless steel kettle with motor driven agitator
Concentrate	From arsenic leach
Concentrate, weight	58 pounds assaying 46.9 percent Hg
Temperature	31° C.
Leach, time	11 hours
Residue, weight	29.05 pounds
Residue, assay	0.05 percent Hg
Solution	135 kilograms at 1.27 specific gravity = 106.2 liters
Solution, assay	114 grams Hg per liter
Extraction, percent	By residue and feed assays = 99.94 percent
	By feed and solution assays = 98.50 percent

A larger electrolytic cell was built and operated using the solutions obtained in this pilot plant test.

In the event that the solutions, after recycling, become fouled with sulphur compounds and possibly arsenic, it is planned for the Hermes plant to bleed off 10 to 20 percent and strip the solution of mercury before discarding. This final stripping will, of course, be much more costly from the power and installation standpoint per pound of mercury produced than from strong primary solutions. Hence, we plan to operate the primary electrolytic cells down to 20 grams per liter mercury content before recycling. We also found by later tests that we could achieve a higher power efficiency if the pregnant solution could be built up to 150 to 200 grams per liter of mercury before electrolysis. This would result in fewer cells, less solution to handle, and consequently a smaller plant. The limit for the current density appears to be about 0.5 ampere per square inch of electrode surface. The current density allowable, however, varies directly with the mercury content of the electrolyte.

Details of the electrolytic cell are shown in the accompanying drawing. The graph shows the rate of depletion of mercury in the electrolyte during cell operation.

These tests on a pilot plant scal: continued to the final production of metallic mercury by electrolysis. Operation cost analysis seems to indicate that this process will be no more costly than furnacing and the plant installation cost will be somewhat lower than a furnace plant. Also, apart from these advantages, the possible recovery of mercury appears to be as high as the best recovery by furnacing and the arsenic problem is eliminated. A 200ton-per-day plant based upon this test work is now constructed at the Hermes mine.

#### **Assaying For Mercury**

The pilot plant test work described in this article required a fast, accurate assay method for mercury in both solid and liquid samples. A brief discussion of the methods used follows:

Ores and Solid Samples: The ore samples and dry test products were assayed by the "test tube" method found so useful at most mercury operations. Refinements of this assay method were related by Bouton and Duschak. To adapt the method to practical application for mine assay laboratories, each chemist varies equipment and methods slightly to suit himself.

Alkaline Solution Assay: During electrolysis and leaching it was necessary to assay the sulphide solutions for mercury content. A 5-, 10-, or 20cubic-centimeter solution sample was taken by means of a pipette. We found that acidifying the solution sample with hydrochloric acid causes the precipitation of the mercury as a sulphide. This sulphide precipitate can be assayed (after filtering and washing) by Seamon's method. This method gives fast results and is accurate enough for control.

### References

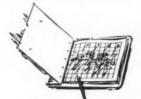
A fairly complete listing of mercury references, by author's name, can be found in:

"A Selected Bibliography on Quicksilver, 1811-1953", United States Geological Survey, Bulletin No. 1019A.

Only those references not found in the above Bulletin will be listed below:

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### From a Geologist's Notebook



Southwest
Copper Gets
Another Look

It was at a New Year's party where the cheer was flowing that we overheard him say, —"and I could put anyone in the ranks of the copper industry majors. All it would take would be a few million dollars." It turned out he was thinking of the American Southwest copper province, that highly productive area of Mexico, Arizona, and New Mexico that has yielded some 30 percent of North America's copper, the

BERNER BARRIER STATE OF STATE

cent of North America's copper, the stronghold of the giants of the industry–Kennecott Copper Corporation, Phelps-Dodge Corporation, American Smelting and Refining Company, the Anaconda Company–and a long-time hunting ground of individuals and companies. Could he be right?

Well, the bloom rubbed off the copper boom in 1956, but long-range exploration continues by many parties, and there is

optimism for new discoveries.

First, the Southwest seems to be a well established major geochemical province where from pre-Cambrian to late Tertiary time copper deposits have been formed. Second, it is said that only 17 percent of the area has exposures of potential ore host rocks. (We think this figure is too low, but certainly 30 percent would be a fair statement.) The proof of successful discovery under cover by modern geophysical-geochemical-physical exploration techniques is given by United Geophysical Company's Pima and Asarco's East Pima discoveries. Third, despite generations of geologic work, many major problems of regional geology have been no more than recognized. Among these, that many volcanic rocks are pre-ore in age and good hunting ground, and conversely that volcanic rocks must not be designated universally as post ore "cover" seems well established but little used. Regional geologic maps, particularly structural studies of high competence are just now in the making. At least one mining company, the United States Geological Survey, and the state of Arizona are at work. Fourth, new concepts of the geochemistry of copper and its association with other elements as "tracers," in local and regional zoning patterns, seem to indicate another reappraisal of the Southwest is in order. Fifth, new concepts of rock alteration, make obsolete settled ideas on exploration of old camps. Team this with widespread recognition that primary copper mineralization of the so-called porphyry type accounts for a major percentage of such deposits, and you have a powerful tool. Sixth, keep in mind that there has been a continued technological lowering of allowables in cut-off and overall copper grade for the Southwest copper deposits since the 1920's. If a permissible mining grade be 0.80 percent today, then its cutoff will be 0.45 to 0.50 percent—not far from the well known bulk grade of the cubic miles of weakly mineralized rock peripheral to many copper districts (0.28 to 0.32). Seventh, remember that many areas are discussed as worthy of potenti

known to mining people for years?

The industry is watching with interest for announcements of the results of Kennecott's and Phelps-Dodge's exploration in largely covered country between Safford and Morenci. It will follow with interest ASARCO's probing through deep gravels on the San Xavier Indian Reservation southwest of Tucson.



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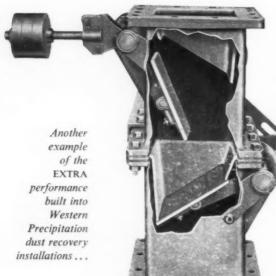
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**Dumping uranium ore at reduction mill in Moab, Utah.** The bluff in the background indicates the terrain encountered by G. P. Decker's Macks, which are . . .

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Tortuous terrain, crisscrossed by deep canyons, arroyos and stretches of drifting sand, characterizes the "Four Corners" area of Utah, Colorado, New Mexico and Arizona, where a large amount of America's uranium is mined.

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### **United States**

### Personalities in the News-

F. A. Wardlaw, general manager of International Smelting & Refining Company, the Anaconda Company's subsidiary in Salt Lake City, and James J. Lillie, assistant to the general manager, have retired from active duty with the company. No announcement has been made of their successors at this time.

Adolph Seaberg was recently appointed general superintendent of Jones & Laughlin Steel Corporation's Lind-Greenway mine near Grand Rapids, Michigan. Mr. Seaberg was previously employed as general foreman of J&L's Hill Annex mine at Calumet, Minnesota.

Robert A. Lubker has accepted a position as director of research with the Alan Wood Steel Company in Philadelphia, Pennsylvania. Mr. Lubker, who was formerly associated with the Armour Research Foundation of the Illinois Institute of Technology, Chicago, will develop a new research department at Alan Wood. One of the department's first projects is the production of iron powder by direct reduction of ore.

Eugene P. Pfleider, professor and chief of the Division of Mineral Engineering, School of Mines and Metallurgy, University of Minnesota, will be visiting professor in the Division of Mineral Engineering with the School of Mineral Sciences, Stanford University, Stanford, California, until June 15, 1958. During this period Dr. D. H. Yardley will serve as acting chief of the Minnesota division.

Dr. B. D. Thomas, scientist and research administrator, is now president of the Battelle Memorial Institute, succeeding Dr. Clyde Williams who recently retired. Dr. Thomas has been a member of the Battelle staff since 1934, when he served as research engineer. In 1943 he was appointed assistant director, and advanced to vice president in 1955.





CHARLES A. STEEN (left), president of the Utex Exploration Company and vice president and director of Uranium Reduction Company, Moob, Utah, has been elected president of the Utah Mining Association for 1958. Other newly elected officers are OSCAR A. GLAESER (right), vice president and general manager of the United States Smelting, Refining, & Mining Company, Western Operations, Salt Lake City, first vice president of the association, and LOCK-WOOD W. FERRIS, president of Bonneville ltd., Salt Lake City, second vice president. A. G. MACKENZIE, vice president and consultant, MILES P. ROMNEY, secretary-manager, and WALTER M. HORNE, assistant secretary-manager, retained their former offices.





P. D. I. HONEYMAN (left) has been elected president of Inspiration Consolidated Copper Company, Inspiration, Arizona, succeeding RICHARD S. NEWLIN who has resigned to give full attention to his new responsibilities as vice president in charge of operations for the Anaconda Company in New York, New York. Mr. Honeyman is a director, and has been vice president and general manager of Inspiration since 1947. He recently received the annual MINING WORLD award as Man of American Mining for 1957. Mr. Newlin was formerly vice president in charge of mining operations for the Anaconda Company, as well as president of Inspiration.

George H. Cobb, assistant to the president of Kerr-McGee Oil Industries, Inc., and executive vice president of Kermac Nuclear Fuels Corporation, recently moved from Oklahoma City, Oklahoma to Grants, New Mexico to carry out his duties. Mr. Cobb is also president of the Ambrosia Lake Uranium Company.

Lockwood W. Ferris, former president and general manager of Bonneville Ltd., Salt Lake City, has been elected president of the company. Mr. Ferris succeeds William L. Bradly, who was selected to fill the newly created position of chairman of the board. T. H. Talbot, consulting engineer and metallurgist of Boston, Massachusetts, was recently elected as a director of the company.

E. C. Stephens, mining geologist in charge of the Anaconda Company's Northwest exploration office in Spokane, Washington, has been elected chairman of the Columbia Section, American Institute of Mining, Metallurgical, and Petroleum Engineers. Mr. Stephens is also head of the Spokane branch of the AIME.

Ben B. Yoffee will succeed Fred Vollmar as president of the Apex Minerals Corporation, Reno, Nevada. Mr. Vollmar will remain with the corporation in another capacity.

Lloyd Erpenbach has been transferred from the M. A. Hanna Company's research laboratory in Hibbing, Minnesota to the Iron Mountain, Missouri, as mill superintendent for the Ozark Ore Company, a Hanna subsidiary. A. E. Cameron, former mill superintendent for Ozark, has been transferred to Lowphos Ore Limited, Capreol, Canada.

R. W. Edwards will replace E. Warren Peterson as superintendent of the Inland Steel Company's Sherwood mine at Iron River, Michigan. Mr. Peterson is now employed as mechanical superintendent with the Caland Ore Company, Ltd. at Atikokan, Canada.

James I. Moore, manager of Haile Mines, Inc.'s New Mexico operations, retired recently following the shutdown of Haile's mining activities in New Mexico. Mr. Moore is now serving as mining consultant in Dulzura, California.

Jesse D. Kirkes has been promoted to refinery shift foreman of International Minerals & Chemical Corporation's plant at Carlsbad, New Mexico. Mr. Kirkes has been employed by International since 1950, most recently serving in the development department as pilot plant operator.

James Lee Cox has been advanced to chief engineer of International Minerals & Chemical Corporation's activities at Bartow, Florida and H. E. Uhland is now flotation superintendent. Mr. Cox joined the company in 1957; Mr. Uhland has been employed there since 1948.

Dr. James L. Calver has accepted a position as Commissioner of the Division of Mineral Resources in Virginia's Department of Conservation and Development. Dr. Calver, who was formerly a geologist for the Florida Geological Survey, will also serve as Virginia state geologist.

Recent promotions at the M. A. Hanna Company's operations are as follows: Marvin J. Hemp, Sr., promoted to pit foreman at the Perry-Carlz operations; Lewis E. Pochucha, advanced to plant foreman at the South Agnew and Weggum operations; Bernard Fors, former pit foreman at the South Agnew mine; John Germert promoted to general pit foreman at the South Agnew mine; John Germert promoted to assistant superintendent at the South Agnew and Morton operations; and Gordon L. Campbell advanced to plant foreman at the Perry mine.

John A. Cooper is now project engineer for mill expansion at the Hayden, Arizona plant of Kennecott Copper Corporation's Ray Mines Division. He will be in charge of expanding facilities at the Hayden concentration mill and the new leach-precipitation-flotation installations.





HANS A. VOGELSTEIN (left), president of the American Metal Company, Ltd., was also named president of the American Metal Climax. Inc., formed recently by the merging of Climax Molybdenum Company and the American Metal Company, Ltd. ARTHUR H. BUNKER, (right) president of Climax Molybdenum Company, is now chairman of the board of American Metal Climax, Inc. Other officers of the new company are HAROLD K. HOCHSCHILD, honorary chairman, and WALTER HOCHSCHILD, vice chairman of the board, chairman of the finance committee, and chairman of the finance committee.



Accident1 But Anaconda SH-D Shovel Cable kept on working in this open-pit mine. Good proof of Anaconda Cable's ability to take it.

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### Newsmakers

### in International Mining

F. T. M. WHITE, professor of mining and metallurgical engineering and down of the faculty of engineering at the University of Queensland, Brisbano, Australia, has returned to Australia following a year's round-the-world tour of mining, milling, and



smelting centers and mining engineering colleges and universities. During this tour he spent four and one half months in Europe, two months in Canada, and two months in the United States. He was an Australian delegate to the Sixth Commonwealth Mining & Metallurgical Congress in Canada during September and October.

John Van Netten has been appointed secretary-treasurer of Pronto Uranium Mines in Canada. Mr. Van Netten is also secretary-treasurer of Rix-Athabasca Uranium Mines, Ltd. Both companies are associated with the Rio Tinto Mining Company of Canada, Ltd.

W. Arnold is now managing director of the Rio Tinto Mining Company of Canada, Ltd. Mr. Arnold was formerly general manager of Freddies Consolidated Mines in Canada.

Dr. W. J. Busschau, manager of New Consolidated Gold Fields, Transvaal, was recently elected vice-president of the Orange Free State Chamber of Mines. Dr. Busschau is also a member of the Gold Producer's Committee of the Transvaal.

R. Dennison Coursen has been appointed director of the Malayan Tin Bureau in Washington, D. C. Mr. Coursen replaces retiring Lynn W. Meekins, who will serve the Bureau in a consulting capacity for the next two years.

J. Brink, formerly associated with Anglo-American Corporation at Johannesburg, Union of South Africa, will replace K. E. MacKay as manager of Bancroft Mines, Ltd. in Northern Rhodesia.

John L. Kellogg, previously employed with the American Zinc Company of Tennessee, is now assistant manager for the Stanleigh Uranium Corporation at Elliot Lake, Ontario, Canada.

HANS NEEB, German mining and metallurgical engineer, is returning home after completing a contract in Colombia, South America where he was associated with the Colombian iron ora, coal, and lime-stone mining section of the government-controlled steel firm.



Acerias Pazvdel Rio, S.A. His trip from Colombia to Germany will take him through Central America, Mexico, United States, Japan, The Philippines, Thailand, India, and Turkey.

Dr. Heikki V. Tuominen, former chief geologist for the Finnish Ore Company of Helsinki, Finland, has accepted a position as associate professor of geology at Lehigh University in Bethlehem, Pennsylvania.

Roy W. Wright, former manager director of the Rio Tinto Mining Company of Canada, recently transferred to London, England to take up duties as director of the Rio Tinto Company, Ltd. of London and the Rio Tinto Management Services (U.K.) Ltd.

New appointments to the board of directors of Rand Mines, Ltd. following the establishment of a new company, Rand American Investments, are as follows: C. S. Barlow, C. W. Englehard, R. B. Hagart, G. V. Richdale, T. P. Stratten, and W. D. Wilson.

Jones R. Castro, metallurgist for Elizalde & Company of Manila, The Philippines, attended the International Mineral Dressing Congress held in Stockholm, Sweden recently. While in Europe, Mr. Castro toured ore dressing plants and mines in Sweden, Norway, and Finland. He also visited smelters, copper refineries, and sulphuric acid plants in Germany, France, and Portugal. From Europe, Mr. Castro traveled to the United States where he visited laboratories of the American Cyanamid Company in New York and the Denver Equipment Company in Colorado. Before returning to the Philippines he will inspect ore smelting processes in Japan.

W. P. Arnold has resigned his position as manager of Freddies Consolidated Mines in the Union of South Africa to accept a position as consulting engineer at Rio Tinto Company, Ltd's uranium mines in Canada.

Yasuichi Mima was recently elected president of the Nippon Mining Company, Ltd. in Tokyo, Japan. Mr. Mima succeeds Kusuo Okabe, now chairman of the board for the company.

G. M. Young, technical director of the Aluminum Company of Canada, has been elected president of the American Society for Metals. Mr. Young is the first Canadian to be elected to this position.

Albert Lee Richardson, formerly associated with Sinclair Oil and Gas Company, has accepted a position as chief petroleum geologist for Republic Resources and Development Corporation in the Philippines.

Roger Testut, engineer for Minerais et Metaux of Paris, France, has returned from a mine inspection trip to the United States. While in the United States, Mr. Testut purchased mining and metallurgical equipment for a new phosphate operation in Africa.

J. B. Coupe, manager, and W. F. Johnston, mining assistant of the Sierra Leone Development Corporation, Sierra Leone, West Africa, recently inspected mining and metallurgical operations in South Africa and the Central African Federation, giving particular attention to tailing disposal systems.

EDWARD H. EAK-LAND, JR., partner in the international geological consulting firm of Eakland & Osterstock has returned to Salt Lake City, Utah headquarters following a twomonth mine examination trip to Chile. While in Chile he made geological sur-



veys of several iron and manganese properties for United States clients. He also visited the El Salvador project of Andes Copper Mining Company.

Parke A. Hodges, consulting engineer with Behre Dolhear & Company of New York City, is currently on assignment in Liberia.

D. P. Britts, O'okiep mill superintendent and C. H. De Beer, Nababeep mill superintendent, both employed by the O'okiep Copper Company, Ltd. of Namaqualand, Union of South Africa, recently inspected concentrators in the Copperbelt. O'okiep has completed expansion of its Nababeep concentrator which is now milling approximately 2,500 tons of ore daily.

Dr. Heinz Kruparz has accepted a position as geologist with the Djawatan Geologi in Bandung, Indonesia. Dr. Kruparz was employed by the Indian government for three years, prior to joining Djawatan.

W. T. Robson is now general manager of Lake Shore Mines, Ltd. in Toronto, Canada. Mr. Robson joined the company in 1930 and has been superintendent since 1952.

D. F. Faithweather, underground manager of Broken Hill South, Ltd. in Australia, recently visited the African Copperbelt as part of a worldwide tour of mining centers.

Arne Lundberg has been elected president of the Swedish mining company, Luossavaara-Kirunavaara A/B, in Kiruna.

S. C. Thomas, formerly associated with the Emperor Gold Mines in the Fiji Islands, is now employed as mine foreman with the Benguet Consolidated Mining Company in Balatoc, The Philippines.

D. P. R. CASSAD, managing director of the C. P. Syndicate, Ltd., the Byramii Mining Combine (Pty.) Ltd., and proprietor of the Rajur Colliery, all located in India, recently attended the I. L. O. Tripartite Technical Meeting held at Geneva, Switzerland for mem-



bers of all mining industries, with the exception of coal mining. The C. P. Syndicate is associated with the C. P. Manganese Ore Company, Ltd., with mines at Bharweli, Ramrama, Kandri, Dongri Buzurg, Jamrapani, Ukwa, and Tirodi, India.

### PRODUCTION **E**QUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.



### **Complete Line Of Heavy Equipment By M-R-S**

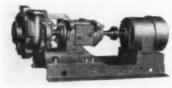
The M-R-S Manufacturing Company, Flora, Mississippi announces the avail-ability of a new catalog entitled "The Complete Line of Contractor Proven High Capacity Equipment." This catalog covers the complete line of M-R-S Heavy Diesel Wheel Tractors and the complete line of allied equipment manufactured for use with M-R-S Tractors.

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for use with M-R-S Tractors.

The new catalog, in addition to presenting brief specifications of M-R-S Tractors and M-R-S Allied Scraper Equipment, also provides a detailed description of the advantages of the M-R-S Hydraulic Weight Transfer. Detailed color plates illustrate the mechanical design of the M-R-S Tractors.

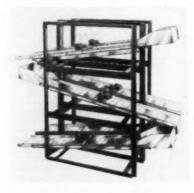
Copies of the new catalog may be secured by writing M-R-S Manufacturing Company, Flora, Mississippi. Use handy reader service card.



### **New Nagle Centrifugal Pumps Have Many Features**

A new series of single stage, end suction, centrifugal pumps, designated the "H" series, has been introduced by Nagle Pumps, Inc., 1249 Center Ave., Chicago Heights, Illinois. Three types of waterends are available to meet specific needs: type "HR" for handling abrasive mixtures where head is limited; type "HC" with split bearing stand for purely corrosive

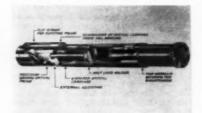
application; and type "HF" for either application; and type "HF" for either abrasive or corrosive applications where high pressures are developed. The discharge end can be rotated to provide a discharge of pumped material in any one of four directions, Simple construction facilitates adjustments. For more informative that the discharge of the provided in the contraction of the contraction o tion write the company direct. Use reader



### Classifier-Concentrator **Recovers Fine Minerals**

The T & R Classifier-Concentrator is designed to recover very fine particles of mineral such as flour gold. Much of this type material is usually lost in the tailings when using more conventional recovery machines; however, according to the manufacturer, Bush Engineering & Manufacturing Co., the T & R unit yields extremely high recoveries.

The unit uses principles of vibration specific gravity, and a reverse riffle slot system. Pitch angles on the machine are adjustable and more stainless steel trays may be added or removed. Each tray will handle up to 250 gallons of water per minute, Circle No. 56 for additional information.



### **New Hand Level Features Quick and Easy Adjustment**

A Locke-type hand level made by Stratex Instrument Company, Inc., in-corporates a simple adjustment principle. The cross hair in the Silver City hand level is engraved on an optical glass index prism which can be adjusted from the outside of the instrument with an ordinary penknife. It is no longer necessary to partially dismantle the instrument or remove the object glass as in older designs. A unique "lazy" vial bubble produces a result that is ideal for simple leveling, grade and profile measurements. Circle No. 53 on the reader inquiry card.



### **Euclid Announces Front** End Loader Model L-7

Euclid Division of General Motors Corp., Cleveland 17, Ohio, has recently intro-duced a new front end loader with a rated payload capacity of 19 cubic feet. Struck capacity of the bucket is 14 cubic feet, maximum lifting load is 3,000 pounds. Compact design of the unit permits operation in confined areas where other power equipment cannot be used. This is the first, and smallest in capacity, of several loader models that will be built by Euclid for bulk material handling. Additional information may be obtained by writing directly to the company. Use handy reader service card.



### **Tomco Produces Line of Drill Core Boxes**

Tomco Products of Houston, Texas have developed an excellent field drill-core storage unit, which provides permanent storage facilities. According to the company this new core box provides both an economical and fast method of storage. Core boxes, made either from galvanized sheet steel or aluminum as illustrated, slide into adjustable steel racks in the same manner as a set of drawers. Boxes are available in a number of sizes and lengths to accommodate all cores. Circle No. 60 for further information.

AN EIGHT-PAGE ENGINEERING notebook bulletin that describes Lead-Zinc Flotation at the Consolidated Mining and Smelting Company's H. B. Concentrator at Salmo, B.C. has recently been published by the Denver Equipment Co., Box 5268, Denver, Colorado. For your copy write and ask for Bulletin M4-B94. Use reader service card.

THREE CUBIC YARD Diesel Dumpers with both front and rear controls are featured in a new booklet by Motor Rail Ltd., Bedford, England. Also featured are their line of small Diesel locomotives ranging in size from 28 bhp and 2½ tons to 85 bhp and 14 tons. Circle No. 1 for your copy.

PORTABLE ALUMINUM PIPE for mine use is described in a new brochure published by W. R. Ames Co., 1001 S. Dempsey Rd., Milpitas, California. Their unique ball coupler, which locks and seals under pressure and is easy to couple and uncouple is also described. Write to company using handy reader service card.

CONSTRUCTION EQUIPMENT LINE: A 24-section, accordion-fold pamphlet describing briefly the complete line of International construction equipment is now available. The booklet covers specs on bulldozers, scrapers, crawler tractors, and other earthmoving equipment. Write to International Harvester Export Co. 180 N. Michigan Ave., Chicago 1, Illinois. Use handy reader service card.

MAGNETIC SEPARATORS: Dings Magnetic Separator Co., 4716 W. Electric Ave., Milwaukee 46, Wisconsin, has available for you a new bulletin on their line of magnetic separators. Dings separators are used in heavy-media separation for maximum recovery of media, and for direct concentration as well. Write to the company for bulletin B-1500. Use reader service card.

HEAVY-DUTY SERVICE from lightweight pipes is the subject covered in Bulletin 507 published by the Naylor Pipe Co. One-piece couplings are also discussed. These couplings fit the complete size range (4 to 30 inches in diameter) of Naylor spiralweld pipe. Write for your copy. Address reader service card to Naylor Pipe Co., 1242 East 92nd St., Chicago 19, Illinois.

WOOD TANKS manufactured by the George Windeler Co., Ltd., 2229 Jerrold Ave., San Francisco 24, California, are described in a new bulletin MW-3. Find out more about the economy and corrosive resistant abilities of wood tanks. Send for your copy of bulletin using handy reader service card.

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MINING WORLD—WORLD MINING

SAN FRANCISCO 5, CALIFORNIA U. S. A. SEVERAL HUNDRED drilling tools and accessories that can save you time and money in core drilling, soil sampling, etc., are described in a new free catalog published by the Acker Drill Co., Inc., Box 830, Scranton, Pennsylvania. Write and ask for catalog 58. Use handy reader service card.

NaClO<sub>a</sub>: With increasing quantities of sodium chlorate being used for uranium ore processing and other applications where an oxidant is required, you will be interested in the free booklet called "Sodium Chlorate—Properties and Safe Handling Practices". Write to Pennsalt Chemicals Corp., 2901 Taylor Way, Tacoma 2, Washington. Use handy reader service card.

NEW ROTARY AIR COMPRESSOR by Le Roi is described in an eight-page bulletin, #P-106B. The booklet describes the Le Roi 600 Rotary. For your copy use handy reader service card to write company direct. Write to Le Roi Div., Westinghouse Air Brake Co., Milwaukee, Wisconsin.

A NEW VIBRATING SCREEN bulletin is now available for you from the Stephens-Adamson Mfg. Co., Aurora, Illinois. The eight-page brochure #757 includes comprehensive technical information and illustrations on both normal duty and heavy duty acreens. Write the company at the above address, using handy reader service card.

MODERN MINING, a catalog on modern, heavy-duty machinery in today's mine, has recently been released by Caterpillar Tractor Co. This interesting booklet shows how the Cat crawlers, tractors, tractor-shovels and motor graders increase production in many ways. For your copy send reader service card to Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

HYDRO-MAGIC is the title of a new sound-color motion picture available from the Bucyrus Erie Co. The film describes the precision control offered by the new Bucyrus Erie all-hydraulic, truck mounted Hydro-Crane. For additional information on the film a pamphlet is available. Send for your copy. Use reader service card and write company in South Milwaukee, Wisconsin.

SHOVEL BOOKLET: Manitowoc Engineering Corp. has recently announced the publication of a 16-page booklet describing their Model 3000 series of 2-yard shovels, draglines and 40-50 ton cranes. Use reader card in requesting your copy. Address to Manitowoc Engineering Corp., Dept. MRS, Manitowoc, Wisconsin.

List information
you want MINING
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you on this card, WE'LL
DO THE REST, NO
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### First All Welded Aluminum Steam Tube Dryer

Above is a picture of an all-welded aluminum steam tube dryer, manufactured by Standard Steel Corp., 5005 Boyle Avenue, Los Angeles 58, California, U.S.A. With the exception of tires, driving gears, trunnion roll assemblies and bed frame, the dryers are constructed entirely of aluminum with stainless steel pads separating the dissimilar metals to prevent electrolytic corrosion. Only aluminum touches product to be dryed. For additional information write to Standard Steel at the above address. Use handy reader service card.



### A New Diesel Crawler Announced by Oliver

The Oliver Corp., 400 W. Madison St., Chicago, Illinois, have recently introduced the OC-15. This new crawler is a high-torque unit, with a six-cylinder Diesel of 529 cubic inch displacement, and delivers 75 drawbar horsepower. The OC-15 has four forward gear speeds ranging from 1.67 to 5.60 mph. For rapid maneuverability, there are reverse gear speeds of 1.99 and 4.48 mph. Controls have new grouped design for simplicity and ease of operation. Write company for further information. Use handy reader service card.



### Wet Reagent Feeder Easy to Maintain

For feeding of all types of wet reagents, the new Knapp & Bates disc type feeder is simple to operate and maintain. Elimination of cups and tilting bars and the use of stainless steel discs feeding from

a tank and being discharged by wipers gives a clean simple design. Feed can be precisely controlled to an infinite degree between 0.3 and 15 gallons per hour per blade. For additional information circle No. 57.



### Locomotive Equipped With Oxy-Catalyst Purifier

The new Universal 1½-ton Diesel locomotive introduced by Hack Engineering Company is equipped with a Dieseler catalytic purifier, made by Oxy-Catalyst, Inc., which attaches directly to the exhaust manifold. The catalytic purifier (shewn by arrow) oxidizes the hydrocarbons, carbon monoxide and other contaminants in the exhaust gases into water and carbon monoxide, Hot gases are led by the flexible tubing and pipe into the water-filled tank behind the operator's seat where they are cooled. The locomotive was designed for mine and tunnel work, is powered by an 18 horsepower Deutz Diesel engine. Circle No. 55 on the reader inquiry card.



### Weight Distribution a Feature of Case Loader

New four-wheel drive Case W-9 Terraload'r, shown in operation above, is claimed to have improved lateral stability because of better weight distribution. Rear wheels carry 40 percent more weight than front wheels, thus eliminating tendency to raise rear wheels off ground when digging or carrying heavy loads. This, combined with hydraulic power steering on rear wheels makes it easy to maneuver in tight spots and on rough ground. Equal power is applied to all wheels at all times through independent differential in each axle. Three interchangeable buckets are available for the W-9, a 1% cu. yd. (heaped) heavy duty digging bucket; 1% cu. yd. standard material bucket, write the J. I. Case Co., Racine, Wisconsin, for additional information. Use reader service card.

### Notes From The Manufacturers

R. E. YOUNG has been selected to fill the newly created position of special representative for the Electric Excavator Division of P & H Harnischfeger Corporation in Milwaukee, Wisconsin. In his new position Mr. Young will work on expanding the mar-



kets for the company's line of large electric shovels. Mr. Young has been employed with P & H for 41 years.

Floyd R. Anderson, chief metallurgist of the Denver division of the Gardner-Denver Company, has been named assistant manager of the division. Mr. Anderson joined the Gardner-Denver staff in 1934 as assistant metallurgist and was advanced to head of the department in 1937. Richard F. Schaffer, former assistant metallurgist, will succeed Mr. Anderson as chief metallurgist.

Henry V. Chase, Jr., has been appointed manager of Hercules Powder Company's explosives operations at Wilmington, Delaware. John E. Greer will replace Mr. Chase as manager of Hercules Pluto Works at Ishpeming, Michigan. Bevier Hasbrouck Sleight, Jr., former assistant manager at Hercules Sunflower Ordnance Works at Lawrence, Kansas, has been appointed manager of the Works, succeeding Mr. Greer.

James W. Clark has been promoted to manager of the Mining Machinery Division of Lake Shore, Inc., at Iron Mountain, Michigan. Mr. Clark joined the company in 1947, and was promoted to chief engineer of the Mining Machinery Division in 1956.

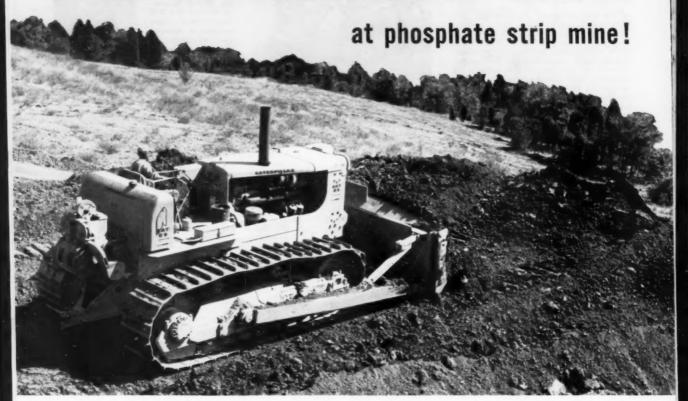
A. W. Knight, executive vice president of Western Precipitation Corporation, has announced that R. F. Stewart was elected a vice president of the corporation. Mr. Stewart was formerly sales manager of the Precipitator Sales Division and was responsible for all sales of Cottrell electrical precipitators, Multiclone mechanical collectors, CMP (Combination Multiclone-Precipitator) units and Dualaire Reverse-Jet dust collectors.

JOSEPH W. LEWIS has been appointed assistant to the president of Beckman Instruments, Inc. in Los Angeles, California. For the past six years, Mr. Lewis has been manager of Arnold O. Beckman, Inc. in South Pasadena. Prior to that time he was



associated with the United States Steel Products Company, a subsidiary of United States Steel Corporation, serving as manager of industrial relations and later as assistant to the West Coast vice president and general manager in Los Angeles.

# D9 DOZES 4,000 CU. YD. OF OVERBURDEN PER 10-HOUR DAY



Here's the remarkable record being made by this giant CAT\* D9 Tractor with No. 9S Bulldozer on a phosphate strip mine near Columbia, Tennessee:

- Averages 16 cu. yd. per 150-ft. pass dozing overburden to spoil bank.
- -Makes 25 passes per hour, working a 10-hour day.
- -Total: 4,000 cu. yd. of overburden moved daily.

And this king-sized production output is not the whole story. The D9 benches for a 3-yd. Lima dragline—working ahead maintaining a 15 to 13-ft. shelf for dragline footing.

No wonder Malcolm C. West, owner of the mining contracting firm on this operation, says: "You need a volume of overburden to make a profit—and I think the D9 is the only dozer capable of doing the job."

That's the story at mine after mine. When the D9 goes into action, owners wonder how they ever got

along without it! Dozing, the D9 can sometimes outwork 2 bulldozers of the next smaller size. With its massive weight and 320 HP at the flywheel, the D9 digs in and pushes bigger loads faster than many new users had believed possible.

Your Caterpillar Dealer is ready to show you on your job exactly how the Caterpillar D9 Tractor can give you high production at low cost per yard. And he's ready, too, to stand behind the long life of this dependable machine with prompt, reliable service and parts you can trust.

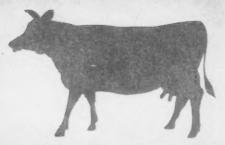
Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

CATERPILLAR\*

\*Caterpillar and Cut are Registered Trademarks of Caterpillar Tractor Co.



# take the SPECULATION out of specs with... MARCY



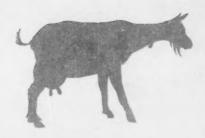
SPECIFICATIONS: 4 legs, tail, ears, eyes, nose, covered with hide, walks. Feed: grass. Product: milk.

The specifications read the same. Which did you want? Goat's milk or cow's milk? Did you expect the production capacity of a goat or a cow?

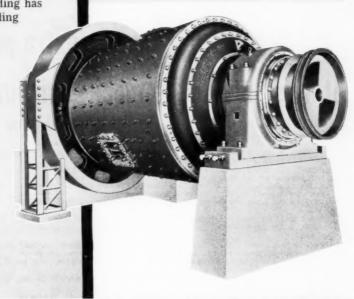
A goat or a cow...perhaps a ridiculous analogy. However, grinding mill specifications may *read* the same, too!

That's why it's so important to look beyond the specifications. When you do you will find the reasons for Marcy's dependable performance...more than 50 years devoted exclusively to grinding has resulted in an accumulation of grinding "know-how" unique in the industry...specialists in grinding research, design and engineering; specialists in selection and use of materials for manufacturing grinding mills; manufacturing facilities developed specially for the best production of grinding mills; metallurgical engineers specially trained in grinding. And, a background of proved performance ... Marcy Mills in 29 different diameter sizes, from 12" to 12' 6" are operating and proved in the field.

These are the factors behind *Marcy* specifications which take the speculation out of specs.



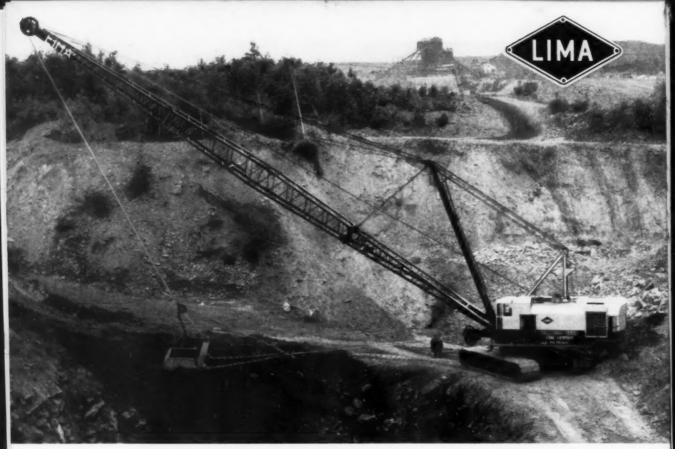
SPECIFICATIONS: 4 legs, tail, ears, eyes, nose, covered with hide, walks. Feed: grass. Product: milk.



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Lima Type 2400 Electric Dragline, owned by Sullivan Trail Coal Co., Pittston, Pa., at work on stripping operation. Power unit combines an a-c motor with a single-stage torque converter to adapt actual power output to work load demand-at constant motor speed.

### LIMA quality means extra production at this 'round-the-clock stripping operation

One of the big stripping operators in the hard coal region is the Sullivan Trail

One of the big stripping operators in the hard coal region is the Sullivan Trail Coal Co., Pittston, Pa. Since its operation is run on a continuous 24-hr. schedule, it demands the utmost in dependability and performance from the Lima draglines and shovels that do the heavy digging.

Sullivan Trail's president, Louis J. Pagnotti, reports: "We want you to know how well pleased we are with the performance of our Lima 2400 and 802 machines. We started buying your Type 2400 Draglines in 1950 and, as you know, we have purchased 11 of them. You will be interested to know that the two Type 2400 Electric Draglines delivered in February and March of 1957 are doing a fine ich. a fine job

"Our six Lima 802 Shovels are used both for digging rock and loading coal. These shovels are doing a good job, also, and have proved to be a valuable investment.

'I wish to compliment you further on your promptness when an experienced factory service engineer is needed. Good service is extremely important to us, as our machines are used continuously. Waiting for a service engineer can be very costly in idle shovel time and loss of production.

"We are pleased with the many new improvments you have made in the latest Type 2400 Electric Dragline."

There's a Lima for every coal mining job—shovels ½ to 6 cu. yds., cranes to 110 tons, and draglines variable. Ask your nearby Lima distributor for full details or write to Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.



Lima Type 802 Shovel, one of six on the same operation.

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LIMA Construction Equipment Division, Lima, Ohlo BALDWIN · LIMA · HAMILTON





... largest iron ore mill installation under one roof in the world

Here, stretching about a quarter of a mile, are 27 Nordberg Rod Mills and 27 Nordberg Ball Mills in a concentrator building up in the Lake Superior Iron Range of Minnesota. The 54—10 foot diameter Nordberg mills reduce hard, abrasive Taconite Iron Ore to the fineness of flour. Four additional Nordberg mills serve as reserve replacement units.

This is but one example of the way in which Nordberg Grinding Mills, in sizes from 6 to 13 feet in diameter and up to 50 feet in length, are successfully serving the ore, mineral, cement and chemical processing industries of the world.

Years of specialized experience in the design, manufacture and installation of process machinery assure you that you can count on Nordberg, its machinery and "know how" to add efficiency and economy to *your* processing operations. For complete details, write for the Nordberg Grinding Mill Bulletin 232.









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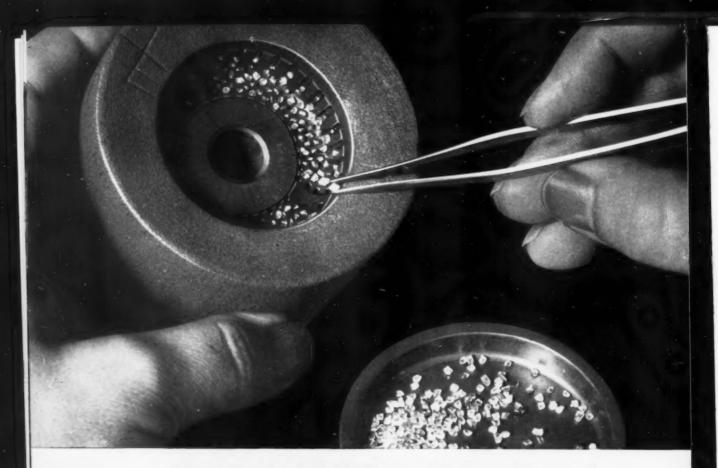


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## Two-Faced Diamonds help us cut your drilling costs

This diamond business sure is different! Here you see a shot of the operation known as "mechanical setting". Of course, the setter is setting the diamonds by hand; they must be set by hand because no machine yet devised has the ability to set diamonds with the "best face to the work" that gives you the better cutting power, longer cutting life and greater footage that you want.

Time was when the setter took the actual bit blank, scribed the pattern, drilled an individual hole for each diamond, set the diamond in, tapped it home, peened in the edges of the hole and, although the technique sounds primitive, turned out a pretty good bit. That was "hand setting".

Nowadays, he starts with a beautiful solid

carbon mold in which the location of each diamond is a precisely spotted cavity. Into each cavity he sets the selected diamond and he still sets it "best face to the work".

This is called "mechanical setting" because it has the advantage of the precise carbon mold. But, for all this modern mechanization, it still has the all-important advantage of an expert eye and a practiced hand placing each diamond as it must be placed for top performance.

The Truco Bits resulting from this combination of mechanization, skill and experience demonstrate their superiority in faster cutting, greater footage, higher salvage, lower diamond cost. Try a Truco and see for yourself.



#### TRUCO DIAMOND BITS by

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### Iron Miners and Metallurgists Meet In Duluth; Talk Scrubbing, Screening, Storage, Reduction

With the theme, "Preparation and Storage of Iron Ore Materials," the nineteenth annual Mining Symposium of the University of Minnesota attracted one of the largest crowds in years to Duluth, Minne-

sota on January 14th and 15th.
Growing concern over the continuing decline in grade of Iron Range ores was evident in the discussions and papers presented. In 1957 there were some 45 beneficiation plants in operation on the Mesabi ranging from simple washing plants to the complex heavy media and cyclone

operations,
One of the subjects which stimulated the most interest was the session on "Scrubbing of Ore Materials." It was announced as a controversial subject and there was general agreement that this part of the program produced the widest variety of ideas and questions

A rather interesting sidelight on this particular meeting was the fact that a substantial number of the papers were given by the representatives of the suppliers of metallurgical and materials handling equipment. There was a general feeling that many of these men have a considerable technical knowledge of their subject and were perhaps better qualified to speak than some of the men working in the field.

The AIME meeting held always a day ahead of the symposium produced papers which were pertinent and reflected the interest of the Minnesota operators

in other areas.

The papers on the Eagle Mountain, California operations of the Kaiser Steel Corporation by M. J. Hughes, manager of the mine, and the "Iron Ore Deposits of Labrador and Quebec" by E. E. Moos, chief engineer of the Iron Ore Company of Canada, drew much thoughtful com-

ment from the large group in attendance.

The activity in the production of iron ore in Canada has aroused the curiosity of many of the Mesabi engineers, as well it should, and most of these men are seeking to get all the first-hand informa-tion available. Further evidence of this desire was reflected in the well received paper on stockpiling at Seven Isles by R. W. Kirkland, terminal superintendent, Iron Ore Company of Canada.

Non-technical subjects covered those on "Engineering Education and Its Problems" by Dr. J. R. Van Pelt, presi-dent of the Michigan College of Mining and Technology, and a discussion of the Science of Human Relations" by Peter Apostolakos, training director of the D.M.&I.R. Railroad. The industry's con-cern with subjects such as these has been

cern with subjects such as these has been noted in other years as part of a program to broaden the outlook of men whose basic interest is highly technical.

Returning to the "Scrubbing" aspects of the meeting the subject was opened by a paper given by R. C. Ferguson, Hardinge Company, Inc., Hibbing, Minnesota, on the "History and Theory of Scrubbing" Mr. Ferguson, set the stage dinge Company, Inc., Hibbing, Minnesota, on the "History and Theory of Scrubbing." Mr. Ferguson set the stage for three other papers by R. C. Engstrom, Mine and Smelter Supply Company, Denver, Colorado; Don Kimball, Pacific Isle Mining Company Hibbing, and George Glumac, M. A. Hanna Company

All agreed that scrubbing makes pos-All agreed that scritting makes pos-sible concentration of ores not otherwise amenable to concentration. The use of log-washers, drum-type, and cone-type washers all came in for considerable discussion. Notable was the point made by one of the metallurgists that his studies showed that scrubbing worked best when fines are not removed from the feed. This fact produced a number of rather searching questions from the audience at the conclusion of the session.

In the preparation of ores for heavy media plants, scrubbing is a most important part of the process, according to Mr. Kimball. The necessity for feed to prevent contamination to prevent contamination of the media is among the many reasons for this preliminary processing. It was brought out that in general the measure of the work done in the scrubbing operation was the amount of power used per ton of feed, and that increasing the speed of the scrubbing operation often raised the power requirements to the point where they became too costly. All agreed, however, that the power requirements for scrubbing were not excessive.

The second session on the "Screening of Iron Ores" was led off by C. R. Phillips, Hewitt-Robbins, Inc., Hibbing, fol-lowed by James Stukel, Cleveland-Cliffs Iron Company, Taconite, Minnesota, and William R. Derrick, Derrick Manufactur-

William R. Derrick, Derrick Manufacturing Company, Buffalo, New York.
Mr. Phillips outlined the problems and Mr. Stukel and Mr. Derrick responded with results from using specific equipment. Mr. Stukel's paper on the use of Dutch State Mines' screens at the Holman-Cliffs cyclone plant created a considerable number of questions on use; Mr. Stukel seemed to feel that the Cliffs experience provided the answers to some experience provided the answers to some specific problems but that to generalize

on other applications was difficult.

The experience with high-frequency vibrating screens by Derrick produced some new information for the industry. Mr. Derrick reported on the application of his company's units and reported that the high frequency screen was particularly useful in the screening of fines. He stated that the higher frequency enabled operators to get more tonnage over the screens than with standard frequency but admitted that there were special problems involved.

A discussion of the design and prepara-tions of tailing sites by John Grant, An-aconda Company, Anaconda, Montana, and Charles Grant, Iones and Laughlin Steel Corporation, Virginia, Minnesota, covered the problems posed by increasing demands of public bodies on anti-pollution and how mining operators could overcome some of these problems. Charles Grant outlined the construction and maintenance of tailing ponds, while John Grant detailed that particular problems involved with the tailings from the An-

aconda operations in Montana.

The final session dealt with the subject of "Surging and Stockpiling" and covered wide range of problems. Richard Derby. Oliver Iron Mining Division, Grand Rapids, Minnesota: Abe W. Mathews, Abe W. Mathews Engineering Company, Hibbing: William McDermott, Pickands, Mother & Co., Hibbing: William Lanctot, Zalk-Joseph Steel Fabricators, Doluth; Alex Patton, Superior Lidgerwood-Mundy Alex Patton, Superior Lidgerwood-Mundy Corporation; and R. W. Kirkland, Iron Ore Company of Canada, made up the panel. Messrs. Mathews and Derby covered the surging design and general considerations and Messrs McDermott, Lanctot, and Paton covered stockpiling.

In large tonnage operations the use

of surge bins and/or piles of various kinds at various stages of the processing seems a necessity, according to the panel members. However, the group seemed in accord on the point that surge facilities should be such that they provide uniform flow of ore into and out of the plant. There seemed to be some who favored surge piles for the removal of finished product and waste also. Stockpiling as a means of accomplishing this same thing was also brought out.

With the growth of plants whose opera tions continue throughout the year, stockpiling becomes a necessity when shipping

Although it was billed as surge piles, this latter point was covered by Mr Kirkland in his discussion of the problem at Seven Isles, Quebec. There, he pointed out, the piles are used for blending ores as well, but that even if this were not the case the stockpiling of ores to keep the railroad shipments at an even rate was a necessity. Last year, he said, the stockpile was reduced about 1,000,000 tons during the time between the opening of the shipping season and the open-ing of the mining season. This particular stockpiling operation is a large one ranging up to almost 2,000,000 tons in storage at times. The reclaiming is done with a group of power shovels loading out the pile at those times when ore is called for

from the surging area.

Last, but not least, and one of the best attended papers of the entire three-day meeting, was given by Dwight C. Brown, assistant director of research, Jones and Laughlin Steel Corporation, on the "Direct Reduction Processes." Mr. Brown outlined what the various processes claimed to be and what his research has various processes found out about the processes. The search for an economical direct reduction process is one which has excited the iron people wherever they might be and this was a review of progress, so to speak, on this subject. Mr. Brown feels that direct reduction is not vet a complete reality in every case but that it can replace or supplement conventional methods only in integrated operations.

One of the more thoughtful men, on

hearing Mr. Brown's paper, remarked that if and when direct reduction becomes more thoroughly developed it will bring about a complete rearrangement of the present schedule of ore cost formulas at

both ends of the Lakes.

Summarizing briefly, the iron ore industry continues to be vitally concerned with improving the product at lower costs and more efficiently. Companies continue to study what each other is doing with the assurance that what works well for one operation will work well for another.

#### **Rosiclare Fluorspar Mine** Again in Operation

The Rosiclare Lead and Fluorspar Mining Company has resumed operations at its property in Hardin County, Illinois. The mine has been closed since March 1954, when reduction in fluorspar prices and reduced orders for fluorspar forced

the company to cease production.

The company has granted leases to operate the mine to Wiley Cochren, M. L. Conn. and Ted Joiner, independent mine operators with offices in Elizabethtown, Illinois. The leases provide for pertown, Illinois. The leases provide for per-centage royalty payments to the Rosiclare Company, and for technical mining su-pervision by Rodnev W. McClusky, min-ing engineer of Golconda, Illinois. Exploration work and mining opera-tions are expected to begin soon.



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#### **Iron Ore Concentrator** To Be Built in Montana

An \$8,000,000 iron ore concentrator is scheduled to be built near Dillon, Montana following an agreement between Minerals Engineering Company of Grand Junction, Colorado and the North Ameri-can Utilities Company of Montreal, Canada. North American will pay for plant and provide working capital. Min-erals Engineering will operate the mill with ore mined from a deposit near Dil lon, controlled by Minerals. Profits will be divided equally.

The mill is expected to produce about tons of concentrates per day from 3,000 tons of ore. The concentrate will be shipped to a steel mill to be built in Canada.

Further exploration of the Dillon iron deposits is planned by Minerals Engineering, Earlier drilling indicated reserves 43,000,000 tons, with recovery of a 60 to 65 percent iron concentrate possi-ble. (See Mining World, September 1956, page

#### **Minerals Conference Set for San Francisco**

The Pacific Southwest Minerals Industry Conference has scheduled 40 technipapers for its annual meeting to be held this year in San Francisco, Califor-nia on March 27, 28, and 29. Conference host will be the San Francisco section of the AIME; co-sponsoring members are the Reno, Las Vegas, and southern

California sections

Chairman Fred Lohse of Kaiser Aluminum and Chemical Corporation, Oakland, California, has announced that the St. Francis Hotel will be conference headquarters. Assistant chairman L. K. Wilson, geologist, American Smelting & Refining Company, San Francisco, has made special arrangements for the conmade special arrangements for the con-ference members to inspect the 2.5-acre working model of San Francisco Bay which is operated by the U. S. Army Engineers at Sausalito, California, This field trip will be on Saturday March 29th.

Program chairman J. K. Brooke, Kaiser Aluminum & Chemical Corporation, and his assistants have arranged the program so as to give emphasis to the use of mineral materials by the chemical and process industries of northern California.

The preliminary program and speakers include the following: the Bretz mercury mine, Malheur County, Oregon by Samuel S. Arentz, Arentz-Comstock Mining Venture, Salt Lake City, Utah; Geochemical Prospecting for Industrial Minerals by Dr. H. E. Hawkes, Division of Mineral Technology, University of California, Berkeley, California; Krupp-Renn Process for the Treatment of Titanium-Bearing Iron Ores by Russell T. Miller, Southwestern Engineering Company, Los Angeles, California.

Other papers will be: Industrial Mincrals Used in the California Steel Indus-try by K. W. Mote, Raw Materials Plan-ning Engineering, Columbia-Geneva Steel Division, United States Steel Corporation, San Francisco, California; Functions of the Menlo Park Western Office of the United States Geological Survey by Dr. David Gallagher, United States Geological Survey, Menlo Park, California; The Use of Precision Photogrammetry to Establish Elevation Control for a Gravity Survey by W. T. Kinoshita, geophysicist,

United States Geological Survey, Menlo Park, California; X-Ray Mineral Aanalysis Techniques by Dr. Ralph E. Wood, Re-search Center, Western Mining Divisions, Kennecott Copper Corporation, Salt Lake City, Utah; The Use of Pyrite and Pyritelike Ores in the Manufacture of Sulphuric Acid by V. A. Fink, General Chemical Division, Allied Chemical and Dye Cor-poration, Nichols, California: Guatemalan Minerals Potentials by Mr. Philip R. Bradley, Jr., mining engineer, Berkeley, California; and Port of Stockton, California nia Iron Ore Shipments by John Heizer,

mining engineer, Reno, Nevada.

Despite the fact that there are no uranium papers scheduled, the mining industry will be very much interested in the paper by Pat Selak, manager, Nuclear Engineering Development, Kaiser Engineers, Oakland, California.

Special events are planned for the ladies and the Conference will end with a dinner dance at the St. Francis Hotel.

The new open-pit operations of Calera Mining Company's Blackbird Division at its property in Lemhi County, Idaho, is currently yielding about 400 tons of ore daily. Isbell Construction Company of Reno, Nevada is currently moving about 12,000 tons of waste daily with 48 men, two shovels of 2½- and 3-cubic-yard capacity, eight 22-ton Euclid trucks, three dozers, one patrol, two rotary drills, and service equipment.

Salmon River Scheelite Corporation plans to complete its current \$90,000 Defense Minerals Exploration Administration project in Custer County, Idaho's Bayhorse district with funds received from sale of its remaining treasury stock to Robert M. Barrett of Salt Lake City. Mr. Barrett then will take over operation of the tungsten mine under a sublease and working agreement. The com-pany will receive half of net profits until it has received \$250,000 and 30 percent thereafter. Frank A. Taft will direct future operations which include construction of a mill and refinery at the property.

Deep exploration of the Silver Mountain Mining Company property east of Mullan, Shoshone County, Idaho is being pushed on a three-shift basis by Hecla Mining Company and the Bunker Hill Company. One heading has been advanced more than 2,800 feet northeasterly from the bottom of the 2,000-foot shaft. More than 1,500 feet of drifting and more than 3,000 feet of diamond drilling also has been done.

Golconda Lead Mines' flotation plant east of Wallace, Shoshone County, Idaho has been operating at capacity seven days a week on custom ores. The firm closed its own mine last June because of low lead-zinc prices. J. A. Featherstone, Wal-

lace, is president.

The three-compartment vertical shaft Lucky Friday Silver-Lead Mines east of Mullan, Shoshone County, Idaho has been completed to the 3,130-foot level. Ore disclosed to date on the new 2,450foot level has been comparable to that found on the 2,300-foot level above. Charles E. Horning, Wallace, is president.

Day Mines, Inc. has dropped about 50 men from its payroll under curtailment of operations because of low metal prices. The firm had 150 employees and 25 lessees, at last report. At the firm's Dayrock mine north of Wallace, Shoshone County, Idaho, the faulted portion of the new Bonanza lead-silver vein had been lo-cated on the 500 level and development ore consisted of fair grade. The vein had been followed 850 feet, of which 675 feet was mineable. Henry L. Day of Wallace is president.

Mining costs at the mine of Clayton Silver Mines, Custer County, Idaho averaged about \$3,000 higher each month during 1957 than in 1956. Mine production averaged nearly 3,000 tons monthly. The firm also started a \$175,000, two-year exploration and development program which included deepening the mine shaft 300 feet to the 800-foot point. W. M. Yeaman of Yakima, Washington is president.

A zone extending 1,000 feet easterly from the Sunshine Mining Company property on Big Creek, Shoshone County, Idaho into the New Purim area will be explored from deep Sunshine workings under a new agreement settling extra-lateral rights questions. *Polaris Mining Company* will receive 47 percent of production, Sunshine 40 percent, and Silver Dollar Mining Company 13 percent. Polaris has abandoned its exploration and mining operations in the easterly portion of New Purim ground from its Silver Summit mine workings because of lack of ore.

The Bunker Hill Company, one of the nation's largest lead producers, has cartailed its Kellogg, Idaho operations because of low prices for lead and zinc, declining sales, and growing inventories of finished metals. The work week of miners has been reduced from six to five days, the 3,000-ton mill has gone from a seven to a five-day week and the zinc plant production has been cut 20 percent. Mine output has been cut 16 percent. A fifth 800-ton ball mill, costing \$130,000, was installed in the concentrator only recently. Aside from its lead and zinc op-erations, the company is developing what it considers to be a promising silver deposit at its Crescent mine in the Coeur d'Alenes east of Kellogg. The firm hopes to bring the mine into production some time this year. According to company offi-cials, the mine could develop into a major silver producer. It will also diversify company activities.

The General Services Administration has declined to set up a mica purchasing depot in the Moscow-Deary area of Latah County, Idaho on the ground that no mines were in active production and there was little evidence of interest in mica mining.

The *Triumph* mine, normally south central Idaho's largest producer with becentral Idaho's largest producer with between 125 and 150 men, had only four men on the payroll at last report. The mine suspended operations some months ago because of low metal prices. Lewis M. Robinson is mine manager for Triumph Mining Company.

Hauling of ore was discontinued late in September at J. R. Simplot Company's barite mine on Deer Creek, Blaine County, Idaho, but a six-man develop-ment crew was retained. Ore shipments are to be resumed in the spring.

A new type of mercury plant, a 200-ton flotation mill, is being installed by

# "Picked'em on past performance!"



Vice-president L. D. Riffe of the Dulin Bauxite Company, Inc., Sweet Home, Arkansas. Using three DW21s and a D9 on the job, in addition to this Cat No. 12 Motor Grader, Mr. Riffe says of his Cat-built equipment: "The only non-operative periods are due to bad weather."

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Holly Minerals Company at Stibnite, Idaho to take the place of the rotary furnace destroyed by fire a year ago. The new mill is expected to virtually eliminate mercury fumes. Holly Minerals bought the mine from United Mercury Mines Company which had been ordered to correct conditions causing mercury vapor poisoning.

Intermountain Mine, Inc. has been incorporated by William and Emma Schierding and James R. and Betty Conley, all of Boise, Idaho, with capitalization of \$500,000.

Rare Metals Corporation of America has been mining about 175 tons of ore daily at its Idaho-Almaden mercury mine near Weiser in Washington County, Idaho, J. J. Snider is mine and mill superintendent.

Silver Star-Queens Mines, Inc. shipped more than \$160,000 worth of crude ore in 1957 from its property near Bellevue, Blaine County, Idaho, and, at last report, had a crew of 20—the largest in south central Idaho's lead-silver-zinc belt. Production was at a rate of more than 300 tons of direct-shipping ore monthly. R. T. Fitz is general manager.

Potash Company of America has suspended operations at its lead-zine-copper-silver deposit in South Mountain, Idaho and at a phosphate deposit in eastern Idaho. The firm had been exploring the Melluee property in Paris Canyon near Montpelier, and retains some leases there for future development.



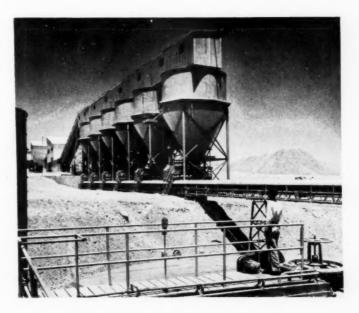
The world's largest vermiculite mine, that of the Zonolite Company near Libby, Montana, is yielding 3,000 tons of mill feed from open-pit operations daily. The company mill is turning out 500 tons of concentrate daily. Orville Thorn is mine superintendent.

St. Paul Lead Company and Merger Mines Corporation have virtually completed constructing and equipping a flotation plant five miles from the old Snowshoe lead-silver-gold mine near Libby, Montana. Milling operations are expected to begin in the spring. An estimated 17,000 tons of ore are immediately available for milling. Blocked out and probable ore is estimated at 283,000 tons. Al Osborne of Coeur d'Alene, Idaho, heads St. Paul Lead. C. H. Hunter of Hayden Lake, Idaho, is president of Merger Mines.

Anaconda Aluminum Company is said to have purchased 2,215 additional acres of land near its plant at Columbia Falls, Montana. Deeds filed at the Flathead County court house are said to have listed the purchase for "plant use." The firm's original plant area covered 750 acres.



Construction of Lakeview Mining Company's \$2,600,000 uranium processing mill north of Lakeview, southeastern



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Oregon, is scheduled to start in April. The mill will have a capacity of about 210 tons of ore daily. It will be supplied principally from the White King mine, where Lakeview has driven some 1,800 feet of underground workings. Ore from other producers also will be accepted. James F. Poulos is mine manager. Dr. Garth Thornburg is company president.

A \$10,420 mercury exploration project is planned by International Engineering and Mining Company at the Axehandle mine in Jefferson County, Oregon. The Defense Minerals Exploration Administration will provide 75 percent of the cost. The company's headquarters is in Santa Barbara, Calif. The firm is a part-

nership of Frank Sylvester, E. L. Cleveland, P. L. Schneider and E. L. Sylvester.

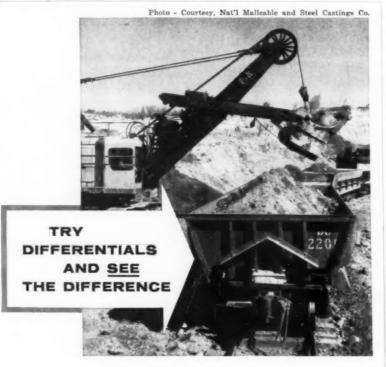
Harvey Aluminum, Inc's new \$65,000,-000 aluminum reduction plant at The Dallas, Oregon is expected to go into production by the end of this quarter, or the early part of the second quarter of this year. Electric tests for the 54,000-ton-per-year plant are already underway.

Ford M. Converse of Portland, Oregon has been granted a \$3,600 Defense Minerals Exploration Administration loan for exploration of a copper deposit at the *Grand Cove* mine, Jackson County. Total cost of the project is estimated at \$7,200.

The Paramount quicksilver property near Greenhorn, Grant County, Oregon, List operated in 1941, has been leased by Wayne Waggoner of Weiser, Idaho, and Gordon West and Jack Milne of Portland. They are planning exploratory work in the spring.

Frank Mayo of Sumpter, Oregon is planning to work placer ground on Cracker Creek south of Bourne in Baker County, owned by Ed Leeck of Baker. Mr. Mayo plans to use a skid-mounted washing plant of about 75-yards-per-hour capacity.

Bolivar Copper Mining Company is planning a milling operation in the spring at its 25-claim property at the headwaters of Cow Creek, near the Douglas-Coos County line in Oregon. Concentrates would be shipped to the Tacoma, Washington smelter. R. F. Carr of Roseburg is company president.



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Northwest Uranium Mines put two drill rigs to work recently on its Spokane Indian Reservation holdings in Stevens County, Washington where the firm previously drilled out an ore body estimated at more than 500,000 tons. Using new wire line core drills, the company is seeking an extension of the main ore body west of a fault. The work was under a third-stage DMEA contract providing for 3,200 feet of drilling at a cost of \$20,193. It would bring the total cost of the exploration project to nearly \$50,000. Dr. F. E. Scott, Wallace, is president.

Clayloon Uranium Company has mined an initial 10 cars of autunite-bearing ore for shipment to the Ford, Washington tranium processing plant. Production was by open-pit methods from the Huffman lease which Clayloon is operating under a profit-sharing agreement with Daybreak Uranium, Inc., which shipped nine carloads of ore from the lease in 1956. Byrl T. Goodwin is president of Clayloon Uranium.

Washington state's second largest gold producer, Lovitt Mining Company, is shipping 240 tons of high-silica content ore daily to the Tacoma smelter of American Smelting and Refining Company. Twenty-eight men are on the pay roll. The firm also produces fruit from an 66-acre orchard on the mine property near the Wenatchee city limits. The 1957 harvest was 20,000 boxes of apples, 30 tons of pears and 45 tons of peaches. E. H. Lovitt is president,

The General Services Administration has opened a mercury receiving depot in Spokane, Washington for producers in the Pacific Northwest and Alaska. Northwest Geochemical Corporation of Spokane has been awarded a contract to weigh, sample, and analyze mercury received through June 30, 1958. The firm is enlarging its laboratory and adding some equipment. Its services include soil analysis. Eugene Gratton is president; Cline E. Tedrow, vice president, and Kenneth R. Bagdon, secretary-treasurer.

A \$9,520 uranium exploration project to be undertaken in the spring by Mudhole Exploration Company of Spokane, Washington under a contract



A new name in metals—American Metal Climax, Inc.—arises from the merger of two well-known companies, The American Metal Company, Ltd. and Climax Molybdenum Company.

American Metal Climax, Inc. now offers expanded facilities and services. Its activities include mining, smelting, refining, marketing, exploration and research. Its products are molybdenum in all forms, potash, copper, lead, zinc, uranium, vanadium, tungsten, tin, solder, metal powders, precious and rare metals, selenium, germanium, tellurium, cadmium, cobalt, bismuth, arsenic, oil and gas, and others. Its interests circle the globe; principal business activities are in North America, Western Europe, and Africa.

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signed with the Defense Minerals Exploration Administration. The site is property on the south side of Mount Spokane in northern Spokane County, where the firm has uncovered showings of autunite and stockpiled 35 tons of ore. Both bul'dozing and drilling are planned. Adolph Nissen is president.

The Admiral zinc-lead mine one mile north of Leadpoint, Stevens County, Washington, is to be explored and developed by Bonanza Consolidated Mining Company under a 10-year operating agreement signed recently. The Bonanza firm has been making some shipments from the adjoining Red Top mine. Admiral Consolidated Mining Company, a Spokane firm, and lessees have mined and milled ore intermittently over the last decade. E. B. Gibbs, Colville mining man, heads Bonanza Consolidated.

Wind River Mining Company has been stockpiling gold-silver ore at its property near Stevenson, Skamania County, Washington, for a mill which management expects to erect next summer. Everett Philpot is president.

A barite prospect 10 miles north of Colville in Stevens County, Washington has been leased by North Star Uranium, Inc. of Spokane. Development plans are being worked out by Robert J. Hundhausen, Spokane mining engineer. John F. Campbell is president.



Union Oil Company of California sold 12,000 barrels of fuel extracted from solid oil shales to mining companies in western Colorado in the last six months of 1957. The shale oil came from the demonstration plant at Grand Valley, Colorado, and was sold to the uranium reduction facilities of Union Carbide Nucleur Company, a division of Union Carbide Corporation at Rifle, Colorado, and molybdenum processing facilities of Climax Molybdenum Company division of American Metal Climax Inc. at Climax. The plant has a capacity of 400 tons of shale ore per day. Operations started in 1957 and this is said to be the first time shale oil has been used in industry. It is sold directly from the ore processing plant without going to a refinery as petroleum fuels do.

United Western Minerals Company has completed its aerial survey of the Tallahassee-South Park area in Colorado and is now in possession of a large block of private land, state leases, and federal lode mining claims. The company located over 30 new anomalies on company property, as well as additional outcrops and some favorable drill holes. Several test shipments were made to the AEC pilot plant at the Colorado School of Mines in Golden, and to the Dow Chemical Company. Marvin Chase, former chief AEC geologist for Colorado and Wyoming, is now in charge of all Colorado exploration and development work for United Western.

New Moline Mining Company has been formed, with headquarters in Montrose, Colorado. Ross L. Dustin is president and general manager.

dent and general manager.

The J. M. Huber Corporation of Borger, Texas is considering the possibility

of reopening its uranium mine in the Tallahassee Creek district of Fremont County, Colorado. The firm mined the Sunshine and Last Chance claims in 1955 and 1956, but was held up in 1957 through litigation proceedings. The autunite ore has averaged about 0.25 percent  $\rm U_3O_8$  in shipments made so far.

Resurrection Mining Company, which has closed down mining operations at Leadville, Colorado, is now dismantling many of the historic old structures for safety reasons. The work will continue through next spring, since winter weather prevents completion. Surface plants at the Ibex No. 2, 3, and 5 shafts of Ibex Mining Company, under lease to Resurrection, will be dismantled; the Ibex No. 4 shaft and surface plant will remain intact. Machinery at Ibex No. 1, Triumph, M&N, Colden Eagle, and the old caved-in Irene No. 1 shafts will be dismantled and proper precautions taken to insure that the shafts are not safety hazards. The present Irene shaft and new surface plant will remain intact, along with new auxiliary service buildings there. In Iowa Gulch, the Julia Fish and Hellena shafts will remain in standby condition. Some dismantling will be done at the Yak, but the office, mill, and changehouse building will remain in readiness for resumption of operations some day.

Trace Elements division of Union Carbide Nuclear Corporation plans to mine about 3,000 tons per month at its uranium property in the Meeker mining district of Moffat County, Colorado. Ore will be processed at the mill in Maybell. Largest output will come from the five Marge claims where the company intends to mine 260,000 tons of 0.10 percent ore this year. About 41,000 tons of similar grade ore will come from the four Maybell claims; 54,000 tons from the five Babs claims; and 2,300 tons from the eleven Bessie claims.

Climax Molybdenum Company recently placed two reconditioned General Electric 20-ton locomotives in operation for development work on the Storke Level of its mine in Climax, Colorado. Both were used by the Montana Coal and Iron Company for a coal mine near Red Lodge, Montana until an explosion closed the mine in 1942. One had been caught in the explosion and was put out of commission. The other was used for cleanup work until 1946 and then abandoned on the wind swept plains of Montana. Climax purchased both, reconditioned them in the Storke Level Locomotive Repair Shop, and placed them in service this past fall. There are now 54 locomotives serving the Storke and Philippson Levels.

James S. Dodge plans additional development work next spring at his uranium claims in the upper Woody Creek area of Pitkin County, Colorado. Ore is autunite, and the deposit is said to resemble the Los Ochos deposit in Gunnison County, both structurally and mineralogically. Overall grade has been about 0.22 percent uranium oxide.



Mines Development Inc. of Edgemont, South Dakota reportedly has received permission from the AEC to increase production at its uranium mill to 13,000 tons monthly. An important addition to the \$500,000 expansion program which the company will now undertake will be the installation of a solvent extraction unit. Biggest ore supplier to the mill is Edgemont Mining and Uranium Corporation, now a part of Giant Resources, Inc.



Uranium Reduction Company is negotiating with the United States Atomic

Energy Commission for an extension of its concentrate sales contracts beyond the present deadline of March 31, 1962. Under present contracts the AEC permits the firm to process up to 540,000 tons of uranium ore during six periods of up to 12 months duration in each, until the expiration of the contract. The AEC has now announced a continuation of its domestic uranium procurement program until 1966. The 1,500-ton-perday mill at Moab, Utah was the first resin-in-pulp type of concentrator to go "on stream" in the United States.

Bear Creek Mining Company has drifted more than 800 feet from its new 1,080-foot Burgin shaft in the Tintic district of Utah. Some mineralization has been found, mostly manganese. Core drilling is also continuing.

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Homer City, Penna.

#### ROCKY MOUNTAIN -

U. S. Steel Corporation's Columbia-Geneva Steel Division has released the details of the \$9,000,000 fluorine control system it now operates at the Geneva Steel Works in Geneva, Utah. Because the iron ore mined at Iron Mountain near Cedar City contains fluorine, significant quantities of which were being released into the air until 1950 when it was first detected. Since then, the firm has been seeking ways of controlling this air polluseeing ways of controlling this air pollu-tion and it has resulted in the elaborate setup at Geneva which daily recaptures about 13,000 pounds of fluorine con-tained in calcium fluoride, About 40 tons of material are removed every day from precipitators at the sinter plant and 90 tons a day from precipitators at the open hearth furnaces.

Howe Sound Company has completed construction of its new \$750,000 electroconstruction of its new \$150,000 exclusive plant for production of higher purlying power in operation. The ity cobalt and it is now in operation. The plant is designed to handle the entire output of the firm's cobalt refinery at Garfield. It should increase operating effi-

Utah Copper Division of Kennecott Copper Corporation has laid off 290 employees at its mine, mill, and refinery in the interest of "more efficient use of the work force.



Vitro Minerals Corporation and the Viro Minerals Corporation and the Atlas Corporation have submitted a joint proposal to the United States Atomic Energy Commission to build a 1,000-ton-per-day uranium mill in the Gas Hills mining area of Wyoming. Vitro stated in the proposal that a \$2,250,000 exploration and development of the proposal that a \$2,250,000 explorations are development. the proposal that a \$2,250,000 explora-tion and development program, con-ducted on only one-quarter of its Gas Hills properties, has indicated reserves of more than 1,500,000 tons of uranium ore. More than 500,000 feet have been drilled in the operation. The company's holdings include 207 claims covering more than 4,000 acres.

Columbia-Geneva Division, U.S. Steel Corporation, has exercised final option on a large group of lode and placer mining claims in the Atlantic City area where the extensive iron ore development is being considered. Documents filed with the Fremont County clerk at Lander, Wyoming, indicate that the company had paid about \$44,500 to Sweetwater County men who held the claims. Claims County men who held the claims. Claims involved are the Hester group in sec. 25, 26, 27, 33, 34, 35 and 36, T. 30 N., R. 100 W., 6th P.M., excepting Rock Creek No. 1 in section 35 and Red Jacket in section 25; Rock Creek lode claims 2, 3 and 4 in section 24; Slate Creek lole claims 1, 2, 3 and 4 in section 35; Robin Hood claims 3, 4, 5, 6 and 7 in section 24; Rozelle placer claim in section 34; the Golden Nugget placer claim and the Gold Star claim in section 25.

The Union Pacific Railroad Company has decided not to let bids for the present on its proposed iron ore railroad from on its proposed from ore railroad from Winton north to Atlantic City, Wyoming. The company had invited a group of contractors to submit sealed bids for the work. (See Mixing World, December 1957, page 43.) The delay probably has been caused by the fact that ColumbiaGeneva Steel Division of U. S. Steel Corporation has not announced any immediate plans for its open-pit taconite mine and beneficiation plant near Atlantic City which would have been serviced by the new spur line.

Operations at the Colorado Fuel & Iron Company's iron ore mine at Sunrise, Wyoming have been reduced to a four-day week. The cutback was said to have occurred because shipments to CF&I's Pueblo, Colorado plant had been reduced from about 3,000 tons per day to 2,500 tons.



James Nash of Austin, Texas and E. W. McFarland of Tucson, Arizona have purchased the Trench mill near Patagonia, Arizona. Nash & McFarland have also leased the Flux mine on a royalty basis, and the Hardshell mine which furnished the water to run the mill. The 200-ton Trench flotation mill has been operated for many years by American Smelting and Refining Company to handle the lead and zinc ores from the Trench and Flux mines. In addition, the plant purchased complex lead-zinc sulphide milling ores delivered to the plant by many of the small producers in the area. The mill was closed down last fall, following the decline in lead and zinc prices. Plans of the new owners are said to include operation of the plant on a custom milling basis.

For the eighth consecutive year, Bagdad Copper Corporation at Bagdad, Arizona, declared a bonus for its employees. Each employee working for the company for one year prior to December 1 participated in the year-end bonus, the amount being determined by the length of employment and straight-time earnings. According to general manager George Colville, the bonus is an evidence of appreciation for efficiency and loyalty, and was given despite the fact that the company showed no profit in 1957.

Magma Copper Company, Superior, Arizona, on January 5, 1958, established a five-day work week for its employees. This is said to be the first time in more than 20 years that Magma has operated on any schedule except a six-day week for its employees. According to the announcement by C. B. Foraker, general manager, the company will continue to operate the mine and smelter seven days a week, but the mill will operate a five-day week, then shut down for two days.

Arizona Governor Ernest W. McFarland is seeking the cooperation and assistance of his fellow governors in the fight to obtain adequate tariff protection for his state's copper mining industry. In letters to the Governors of the other 47 states, he outlined the serious problem confronting the state of Arizona as a result of the "disastrous tobogganing" of the copper price. He stressed the point that present tariff protection and the 24¢ peril price are out of line with current production costs, and stated that an exhaustive study had indicated the justification of a 32¢ peril point and restoration of the original 4¢ excise tax.

Fred F. Powell was the recipient of a \$100 safety award from the Magma Copper Company, Superior, Arizona. The award was in recognition of the 14,000 man-shifts which he had supervised without a lost-time accident. Mr. Powell also was paid a safety bonus of \$420, at the rate of 3 cents per man-shift, in accordance with Magma's policy of doing everything possible to promote safe working conditions.

Storall Manganese Company is shipping from two to three carloads of metalurgical-grade manganese each week under the government purchase program. Part of the ore comes from the old Lake Superior and Arizona mine at Superior, part from properties in the vicinity of Casa Grande, and the remainder from near Socorro, New Mexico. The ore is trucked to the company's treatment plant at Casa Grande where it is blended and prepared for shipment to GSA's stockpile. Principals in the company are Al Stovall, Orville K. Mills, and Virgil Short.

The Tailings and Dump Concentrating Company has installed gold-recovery equipment at the old Vulture tailings dump at Wickenburg, Arizona. The project is backed by Dallas, Texas interests with J. W. Crotty in charge.

A gypsum deposit near Camp Verde, Arizona, has been brought into production by the Verde Gypsum Company and about 27 tons a day are being trucked to the Phoenix area for sale to agricultural chemical companies. The deposit carries practically no overburden and is said to require no blasting. President of the new concern is Gordon R. French of Phoenix. Associated with him are Vincent and Kenneth Neils.

The Westminster Corporation of Denver, Colorado has acquired two mercury properties in Arizona. The Pine Mountain and Mercurio mercury mines located 67 miles northeast of Phoenix in Maricopa County have been purchased from Western Oil Tool and Engineering Company Inc. of Pasadena, California, along with drilling, mining, and milling equipment. Western Oil Tool will be operated as a wholly owned subsidiary of Westminster. Work has started on the Pine Mountain mine and the company hopes to be milling between 40 and 50 tons daily shortly. Plans are being made for another 100-ton-per-day mill, and it is expected that this mill will be installed by the fall of this year.

A review of Arizona's natural resources has been prepared by the Arizona Research Consultants for the Arizona Development Board. This up-to-date summary is available free to interested parties if they write to the Board at 1521 West Jefferson Street, Phoenix, Arizona.



Kern County Land Company is the latest entrant in the search for saline deposits in California's Mojave Desert. The firm is reported to have leased property from J. E. Ventresca. Kern County Land Company established a hard minerals department in 1956.

Harry Gorton and associates of Desert Hot Springs, California are reported to

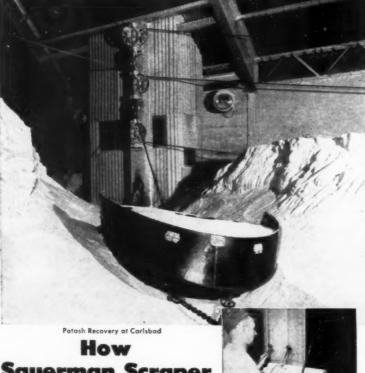


Photo Courtesy Kaiser Steel

#### Kaiser's \$194,000,000 Expansion Now Underway

Kaiser Steel Corporation's \$194,000,000 expansion program is well underway at the Eagle Mountain mine near Riverside, California and mill at Fontana, California. Production from the mine will soon be stepped up to meet the requirements of a fourth blast furnace now under construction at the Fontana mill. Pictured above is one of five, 64-ton, semi-trailler dump trucks, said to be the largest rear dump semi's ever built, now in use at the Eagle Mountain mine to haul ore from the open pit to the crushing plant. The trucks are the first five units of this model produced at Kenworth Motor Truck Corporation's plant at Seattle, Washington, and five more are to be purchased by Kaiser in the future. Too large for travel on ordinary highways, the trucks were shipped by rall in three sections and assembled at the mine. When expansion plans are completed in mid-1958, Kaiser Steel is expected to be the largest steel producer west of the Mississippi River.

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have leased the old Mountain Belle gold mine near Soulsbyville in Tuolumme County, California. The 110-foot shaft is being reopened and retimbered.



Kennecott Copper Corporation and Consolidated Coppermines Corporation are reported to be negotiating over the possible sale of Consolidated's property in Nevada to Kennecott. The two firms have been operating jointly near Ruth, Nevada for a number of years. In addition, Consolidated has been mining from the Tripp open pit which adjoins Kennecott's Veteran pit. Output of all three of Consolidated's properties is treated at Kennecott's concentrator and smelter at McGill. If the negotiations are completed, Consolidated would step out of the copper mining field after more than 40 years as an active producer. The firm has been diversifying its operations in recent years.

United States Mining and Milling Corporation, which purchased the Bruhi mill near Silver Peak, Nevada more than a year ago, is reported to be ready for operation. The plant will treat ore from the Nicloc silver and gold mine which is also owned by U.S. Mining, and will handle custom ore from mines within a 100-mile radius. Samuel L. Levine is president of the company.

The \$1,050,000 skip haulage system being installed by Consolidated Copperation at its Tripp pit at Kimberly. Nevada is about completed and should go into operation by April 1. Streamlining of the ore haulage system was undertaken as a major cost-cutting project necessitated by rising production costs.

The Humboldt County (Nevada) Board of Commissioners have granted permission to Robert L. Snyder of Las Vegas to explore and develop two patented mining claims in the Blackrock and in the National mining districts.

Nevada Mines Division of Kennecott Copper Corporation has purchased a new drill and a new crawler tractor for its operations in the Liberty and Veteran pits. During 1957, Kennecott started full-scale ore production from the Minnesota-Hi orebody, although partial production had started in 1956. The actual tonnage drawn from this salvage operation in 1957 exceeded the highest previous annual tonnage rate achieved at the old Ruth mine in any year since 1929.



Farm Chemical Resources Development Corporation has completed sinking of its 15-foot, concrete-lined, circular shaft at its property 30 miles northeast of Carlsbad, New Mexico. The shaft is 1,623 feet deep. Next major step is designed and construction of a mill. Preliminary tests have been made on ores

from other mines in the vicinity, and some investigation has been made of European techniques for processing high slime content ores similar to some found in the Carlsbad area.

An estimated 180,000 tons of uranium ore has been located on 30 acres of the 14,000-acre San Mateo Dome near Grants, New Mexico. Lisbon Uranium Corporation has an undivided 36 percent interest in the property and has filed an application for a \$250,000 DMEA loan on approximately 20 percent of the project. Mineral Project-Venture B Ltd. is also associated in development of the property.

Great Lakes Carbon Corporation is building a new crushing and sizing plant at the site of the No Agua perlite deposit in northern New Mexico. Upon completion in June 1958, it will be the perlite industry's most complete and most modern processing plant for crude perlite. Until the new plant is in operation, the firm will process the ore at its existing plant in Florence, Colorado.

The newly formed Barite Corporation of America reportedly is building a \$200,000 barite mill in Bernalillo, New Mexico. The mill will treat barite from a deposit in the Sandia Mountains about eight miles east of the town.

Development work at the Questa property of Molybdenum Corporation of America in Taos County, New Mexico is continuing satisfactorily. The firm is operating under a \$510,500 DMEA loan. The adits are being extended and the diamond drilling program pursued. The first hole showed mineralization 400 feet vertically above the adit level. Additional drilling is being done to determine how much of the 2,000 feet above the Adits of which the 400 feet is part, is mineralized.

Dotson Minerals Corporation of Socorro, New Mexico is producing magnetite from the Jones open-pit mine about 35 miles northwest of Carrizozo, New Mexico. The ore will be graded and processed on the site and shipped to a Texas port where it will be used to anchor underwater oil pipes in the offshore and tideland properties.



Bear Creek Mining Company, exploration subsidiary of Kennecott Copper Corporation, has been diamond drilling near Loon Lake in Cook County, Minnesota. This is the area where the Duluth gabro forms the southern boundary of the Rove formation, and is about two miles south of the international boundary with Canada. It is understood that the firm is seeking nickel.

Mining operations at the American Zinc, Lead and Smelting Company's Nellie B property in Oklahoma and Vinegar Hill division in Wisconsin have been discontinued. A small crew is continuing on development at one mine there. The Piquette mine in Wisconsin is still operating.

General Testing Laboratories of Kansas City has opened an ore assay office in Willow Springs, Missouri not too far from the West Plains area where a lowgrade iron ore industry has been expanding. A branch may be established in West Plains if the need exists. Meanwhile the Willow Springs office will probably analyze more iron ore than any other ore, although it is known that manganese, copper, zinc, and lead also exist in the area. Grant Cookson is in charge of the office.

Michigan Tech has dedicated its new \$1,600,000 civil engineering and geological engineering building on the campus at Houghton. The geological facilities provide additional laboratory space for geochemistry, paleontology, mineralography, mineralogy, petrology, economic geology, and lapidary studies.

Certain rare earth metals—gadolinium, dysprosium, erbium, and yttrium—can now be obtained in commercial quantities from Michigan Chemical Corporation's Rare Earths and Thorium Division in St. Louis, Missouri.

The Frisco Railroad Company in cooperation with the special iron ore committee of the West Plains, Missouri Chamber of Commerce, has purchased 79 acres of land adjoining the northwest suburbs of the city for establishment of an iron ore loading siding and for future industrial sites. Sellers were J. W. and Bob Hayes. The Frisco firm reportedly plans to spend between \$65,000 and \$100,000 for the land and a 4,000-foot siding which will have entrances on the main line at both ends.

The Ozark Ore Company, a subsidiary of M. A. Hanna Company, closed down its underground mining operations at Iron Mountain, Missouri for a short



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period while five conveyor belts and the primary crusher were moved to a lower level. During the shutdown, the surface plant continued to operate from the stockpile.

A method developed by the U.S. Bureau of Mines will be used commercially to beneficiate bauxite from the Quapaw deposit in Saline County, Arkansas, and make it suitable for alum production. The bauxite ore tested by the Bureau contained two to three percent iron oxide, slightly more than can be tolerated in alum production. Treatment by the new process reduced the iron-oxide content to less than two percent. It is believed the procedure can be applied with equal success to similar offgrade ore elsewhere in Arkansas.

The Minnesota School of Mines and Metallurgy has been reorganized and now comprises three divisions-Mineral Engineering, Metallurgical Engineering, and the Mines Experiment Station. Physical Metallurgy has been transferred to the School of Chemistry. Separate cur-ricula are now available in Metallurgical Engineering, Geological Engineering, Mining Engineering and Geophysics, and Metallurgy



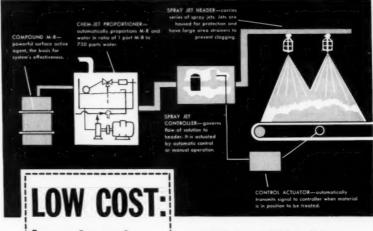
The 66-inch-diameter ventilation shaft being drilled by American Zinc Company of Tennessee at its new Young mine at New Market, Tennessee was past the 450-foot-deep mark at year's end. The goal is 600 feet by March 1. See Minne World, September 1957, pages 60-63 for a complete description of the revival of the art of drilling large-diameter shot boles or Calvy holes. holes or Calyx holes

Magnet Cove Barium Corporation, re-Magnet Cove barum Corporation, reported in Minisc Woist, November 1957 page 83 as acquiring the Williams barite mine at Del Rio, Tennessee from New Jersey Zine Company, has now started drilling. A diamond drill is being used to determine the tonnage of ore available to an adit entrance.

Arrangements are being made to deepen the Ore Knob mine shaft of Appalachian Sulphides Inc. another 300 feet to 1,280 feet for two new levels. The property is located in Ashe County, North Carolina. Milling will remain at the 400-ton rate until the price of copper improves. The company's Elizabeth copper mine in Vermont is expected to close soon with the depletion of the ore, but negotiations are underway for two new cepper prospects located within 150 miles of the Ore Knob. Both will be drilled. In New York state the company holds a magnetite property, the *Croton*, where tonnage estimates are anywhere from 8,000,000 to 30,000,000, averaging 30 percent iron. Operating problems are difficult here. Appalachian is a wholly owned subsidiary of Nipissing Mines Company Ltd. of Toronto, Canada.

Directors of Callahan Zinc-Lead Company and Vulcan Silver-Lead Corporation are reported to be considering the pos-sibility of merging Vulcan into Callahan. Callahan presently owned 62 percent of Vulcan's outstanding stock. Vulcan owns a silver-lead and copper-silver property

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in Idaho currently being developed and operated by American Smelting & Refining Company under an agreement. Callahan is not presently mining, but is exploring for mining properties in Canada.

Jones & Laughlin Steel Corporation has become the first major steel company in the United States to use the basic oxygen steelmaking process. Production of steel by this method started in December at the company's plant at Aliquippa, Pennsylvania. Two furnaces there, only one of which will operate at a time, have a total annual rated capacity of 750,000 tons. They are the largest in the world, and cost about \$11,000,000 to install. These furnaces represent a capital investment of only \$15 per annual ingot ton, however, as compared with at least \$40 per annual ingot ton for new open-hearth facilities.

American Potash and Chemical Corporation has reduced the prices on a number of lithium compounds and has introduced a new line of rubidium and cesium compounds which will sell at lower prices. Lithium carbonate has been reduced from 73¢ to 67¢ per pound in carload lots. The rubidium and cesium chemicals will sell at about 13,00¢ to 27,50¢ per pound.

Koppers Company Inc's Metal Products Division is making four electrostatic precipitators for the New Jersey Zinc Company. Three will be installed in a flash-type roasting operation at New Jersey's zinc plant at Palmerton, Pennsylvania, and the fourth will be an acid-mist precipitator for the company's calcining operation at Gloucester City, New Jersey. Both units are scheduled for operation early this year.

Applications for the 1958-1959 Henry Krumb Scholarships in the School of Mines at Columbia University in New York City must be submitted to the Office of University Admissions by the middle of February. Open to candidates for degrees in mining, mineral, and metallurgical engineering at Columbia, the scholarships have a value of \$1,500 per year, plus traveling expenses from the student's home to New York. Up to six awards are made each year, based solely on the high school and college performance records of applicants.

New Jersey Zinc Company is reported to have invited Tennessee Senator Albert Gore, who is opposed to a tariff on zinc, to inspect its new zinc mine at Treadway, Hawkins County, Tennessee. This newly developed mine and new 1,000-ton-perday mill are standing idle because of the current low zinc price.

The New York Section of the Alumni of the Michigan College of Mining & Technology will hold a dinner on February 18 in the Penn Top of Hotel Statler in New York City in conjunction with the annual meeting of the AIMME. Scott Turner, winner of the 1957 Hoover Medal for distinguished public service, sponsored by the AIMME and three other engineering organizations, will be the guest of honor at the dinner.

The Maine Geological Survey, a division of the Department of Economic Development, is undertaking an aeromagnetic and geologic reconnaissance survey of an area comprising 1,000,000 acres in south central Maine. The project has been contracted to the James W. Sewall Company, consulting engineers at Old

Town, Maine, with the aeromagnetic survey sub-contracted to Aerogeophysics, Inc., Los Angeles, using a Varian nuclear precession magnetometer. The aeromagnetic survey includes three widely groups of long flight lines with fill-in in anomalous areas. Geologic mapping in-cludes compilation of reliable data from various published and unpublished sources in addition to reconnaissance mapping on the ground and from the air. John R. Rand, State Geologist, anticipates that the survey will be completed late in February.

Diamonite Products Manufacturing Company, a division of U. S. Ceramic Tile Company, has added another new continuous tunnel kiln to its operations at Shreve, Ohio. Further enlargement of capacity was required because of the rapidly expanding market for high alumina ceramics.

United States Smelting Refining and Mining Company's wholly owned sub-sidiary, U.S.S. Lead Refinery, Inc., has placed a new unit in operation at its East Chicago, Indiana facilities. This re-finery receives lead bullion from the smelting company's Midvale. Utah smelter. At East Chicago it is refined electrolytically to produce an extremely high purity corroding grade lead. The slimes from the electrolytic refinery are stimes from the electrolytic refinery are pumped to the new unit where they are filtered, washed to remove and recover the electrolyte, mixed with flue dust, dried and calcined in a four-hearth roaster. The calcined material is further treated in reverberatory furnaces and, by selective oxidation, dore metal and other byproducts are recovered.



United States Metals Refining Company, a subsidiary of American Metals Company, Ltd. has completed its diamond drilling program on the Keweenawan formation north of Wakefield, Michigan, where the firm controls about 20,000 acres. On the basis of 132,000 feet 20,000 acres. On the basis of 132,000 feet of diamond drilling, the company esti-mates a deposit of about 50,600,000 short tons of copper-bearing shale with an average copper content of 1.52 percent. An additional 54,000,000 short tons of lower-grade shale with an average content of 1.04 percent also exists. The development shaft being sunk on the main deposit is nearing its objective. The 215foot shaft will be used to determine the character of the formation and for samp-

W. S. Moore and Company is exploring some low-grade magnetite iron ore bodies in the area around the Benson mines of Jones & Laughlin Steel Corporation near Newton Falls, New York. The firm has been investigating this area since late 1956. Results so far are satisfactory, and cores are being tested at the Eric Laboratory in Hibbing, Minnesota. If sufficient ore is developed, a 300,000 to 400,000 ton concentrating plant is planned. One of the properties being tested is owned by the Newton Falls Paper Mill Inc. and the other by International Taw Company of New York.



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STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD C5125
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Erie Mining Company has shut down its preliminary taconite plant at Aurora, Minnesota. The plant was placed in operation in 1948 and has been used to develop ore treatment methods for the commercial plant. The latter has been gradually going into production and the preliminary plant is now no longer needed. It will be maintained on a standby basis for emergencies. Personnel of the preliminary plant are being transferred to the commercial operation.

The Duluth Missabe and Iron Range Railway has decided to convert completely to Diesel equipment. In conjunction with these plans, the firm has placed orders for 28 locomotives for delivery prior to the 1958 ore shipping season. Over the next two years, it plans to purchase 36 additional units to complete the conversion. This marks the beginning of the end for the "mallet" type of steam engine which has been hauling ore from the Mesabi Iron Range to upper lake ports for about 20 years.

Arbitration continues in the dispute between Mesabi Iron Company and Reserve Mining Company involving financial statements of Reserve Mining Company's 1956 operation. Under the original agreement Reserve was to pay Mesabi Iron one-third of all profits from taconite operation at Babbitt and Silver Bay, Minnesota. This agreement was based on land leased by Mesabi Iron to Reserve for mining operations. In April

1957, arbitration began between Richard C. Klugescheid, president of Mesabi, and William K. Montague, Minnesota counsel for Reserve Mining. Recently a third arbitrator, Dr. Wesley A. Sturges, has been named ti the board in an effort to fiinalize all points of dispute.

The Canton mine of Oliver Iron Mining Division, U.S. Steel Corporation, at Biwabik, Minnesota has been closed because of exhaustion of ore. This mine became active in 1893 as an underground operation for Minnesota Iron Company. Oliver developed the mine into an openpit operation in 1947 and made total shipments of more than 14,000,000 million tons. The Canton thus joins the recently depleted Bivabik mine of Pickands Mather & Co., in the eastern area of the Mesaba Iron Range.

The pelletizing plant of Reserve Mining Company at Babbitt, Minnesota, has been closed down because of the reduced need for iron ore. Reserve's big plant at Silver Bay, Minnesota, will be able to fill the requirements of Armco and Republic Steel Corporation at the current steel production rate. Most of the 140 employees of this Babbitt plant have found employment at Erie Mining Company in Aurora and other iron mining companies in the area. This decision will not affect the 1,000 employees in the Babbitt mine, crushers, or railroad shops.

The Republic Steel Corporation has closed its Tobin iron ore mine near Crystal Falls, Michigan for an indefinite period because of "economic conditions" and a surplus of iron ore.

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#### **New Mercury Ore Reserves** Found at Red Devil Mine

DeCoursey-Brewis Minerals, Ltd. in-DeCoursey-Brewis Minerals, Ltd. increased mercury production as well as proven ore reserves at the Red Devil mine in Alaska during 1957. Mercury production for the first six months of 1957 totalled 2,412 flasks (183,312 pounds). Alaska's entire mercury production for 1956 was 3,414 flasks. The company, by sluicing a surface area on the Red Devil's fault, uncovered six new ore shoots (the Dolly veins). The

six new ore shoots (the Dolly veins). The new "Dolly" shaft has been sunk to a new "Dolly" shaft has been sunk to a depth of 146 feet and the main shaft raised from the 450-foot level to the 300-foot level. As a result, positive ore reserves have increased. Further development at the mine includes a new head-frame and hoist now in operation and a trestle to the mill bin recently erected.

Robert Lyman, formerly director of Robert Lyman, formerly director of the subsidiary company, DeCoursey Mountain Mining Company, Inc., was re-cently appointed manager of the Red Devil mine, which is the largest mercury producer in Alaska.

#### U.O. Market Needed For Klerksdorp Ores

Prospecting and development of Klerks-dorp Consolidated Goldfields, Ltd's ura-nium deposit in South Africa have been suspended until a market is found for

the company's ore. Klerksdorp has developed a substantial ore reserve of high grade or at relatively low cost. At the end of June 1957, development and drilling had proved an estimated ore reserve of 1,648,800 tons averaging 1,59 pounds over a 36-inch or 607,700 tons averaging 4.31 pounds of uraniun per ton over a 13.27-inch area. Stoping and sorting tests have indicated that both grades can be mined and treated successfully. These grades are exceptionally high for South African uranium, which is normally a by-product of gold.

Because this company is not on the list of uranium producers established by the Combined Development Agency formed by United States, United King-dom, and Canada to Cavelop and pro-cure uranium sources), the Agency has declined purchase of Klerksdorp ore of-fered for sale by the South African Atomic Energy Board. The Board is now carrying on preliminary negotiations with other prospective buyers and all uranium operations have been shut down until

negotiations are completed.



MALAYA-Sungei Besi Mines Ltd. has installed a new belt conveyor and it is expected that the tin yardage dredged will be substantially increased, resulting will be substantially increased, resulting in a reduction of operating costs. Due to this lower grade, gravel will be dredged which will increase the life of the property. The ground will be mined systematically without attempting to equalize the grade.

BURMA-The West German firm of Krupps will survey the iron and coal de-posits in Burma, reportedly financed by a free gift of \$50,000 from the West German government. The area selected for the iron survey is Panquet in the Taunggyi district, where preliminary explora-tions have located a deposit of high-grade iron ore at a depth of 250 feet. This de-posit is estimated to be 2½ miles long and 400 feet wide, and to contain 40,-000,000 tons of iron ore, Coal deposits at Kalewa in the Shan states and at Padaung-taung in the Arakan Yomas, east of Andrew Bay, will be examined. The great problem will be providing means of transport.

JAPAN—The Japan Copper Metal Holding Company, organized by the Japanese smelters, has applied to the Japanese Government's Fair Trade Commission for approval of a plan to buy sur-plus stocks of electrolytic copper from smelters. The firm hopes to buy a total of 2,000 tons if credits could be obtained for this purpose. The current anti-infla-tionary program is opposed to supplying new credits to the copper smelters to finance the holding of growing stocks of electrolytic copper, but the company hopes for a change in attitude because of the difficulties facing the copper industry. If new credits are not provided to tide the smelters over this period of growing surpluses, the smelters might be forced to sell part of the stocks abroad at very low prices, according to the new

INDIA-Arrangements have been completed between Birla Brothers and a reputed German firm to start an aluminum plant at Rihand in the Uttar Pradesh. The rated capacity will be 10,000 tons of aluminum annually, with the plant ex-pected to start production before 1961. The German firm will supply the needed foreign exchange, machinery, and technical aid.

AFGHANISTAN-A three-man team United Nations geologists is reported to have located large deposits of nium in Badakhshan province in north-eastern Afghanistan. Preliminary exami-nations have shown that the deposits are available in commercial quantities. Samples are now undergoing laboratory test-

ISRAEL-The Timna copper plant near Elat is expected to go into produc-tion early this year. It is estimated that local deposits (once the King Solomon copper mines) contain about 3,500,000 tons of ore. The plant will have an annual concentrate capacity of 7,000 tons, and its output will be exported for further refining.

THAILAND-The Thai Mines Department is reported to have asked for permission from the Cabinet to expand tin smelting at Bangkok in order to meet local needs. At the moment some smelt-ing for Thailand is done at Penang in

WEST PAKISTAN—The government has officially established the West Pakis-tan Mineral Development Corporation to resources of the province. The Corporation to facilitate the development of the mineral resources of the province. The Corporation will have a capital of Rupees I corporate and will be managed by a board composed of the chairman and three or more directors. The head office of the corporation will be in Lahore. The group will be entrusted with the task of drawing and province of the corporation will be composed of the corporation will be in Lahore. ing up plans for surveying, exploring,

prospecting, mining, processing, and industrial development of the mineral wealth of the province. It would also suggest ways and means for the improvement of communications, water supply, power, and other ancillary problems of the areas selected for such development. The Corporation has also been empowered to sponsor public companies for implementing plans formulated by the

MALAYA—After a close examination of the properties of the *Kepong Dredging Company*, the Group Chief Prospecting Engineer has recommended that a comprehensive drilling program should be undertaken. This is now underway and results obtained so far indicate that the dredging life of the property may be extended beyond the original estimates.

TURKEY—A new mining company, Bayindirli Ticaret ve Maadin Ltd., has been organized. The main shareholder is H. Bayindirli who is also the general dealer for International Harvester Company of the Compa pany, Westinghouse Electric Company, and Baldwin-Lima-Hamilton in Turkey. The company is interested in copper, nickel, chrome, and manganese prospects in Turkey.

ASIA—Satisfactory progress is being made on completion of the first geological map of Asia by a group of 15 geologists working through the *United Nations Eco*nomic Commission for Asia and the Far East. The final map is expected to be published by the end of this year and the group urges that regional maps be prepared next to show the distribution of mineral resources in Asian countries. At a meeting in Calcutta, attention was cen-tered on the geological surveys of border areas which were undertaken by Thailand and Malaya. Significant discoveries were made as a result of the surveys, and hope was expressed that other Asian countries would also start joint surveys of border areas. In examining the regional geological map, the meeting found incongruities in rock evolutions on either side of the national boundaries between Thailand and its neighbors. It therefore asked governments to consult with each other, and, if possible, reach conclusive findings.

BURMA-Representatives of the Burmese government met with United States mining engineers in Washington, D.C. recently to present the incentives the Burmese government is offering to attract foreign capital and technical assistance in developing the country's mineral resources. The Burmese Minister of Mines, U. Raschid, and the Ambassador to the U.S., U. Win, outlined the government's policy and measures designed to attract foreign mining groups. These include tax concessions, guarantees against nationalization, and preferential treatment for imports of capital equipment. Since there is still insufficient factual data available on extent and location of ore deposits, a geological survey would be desirable.

IRAN-The country's nonferrous metal mines are being surveyed by a group of Japanese mining experts. Two geologists and four mining engineers form the team which is investigating copper, chrome, zinc, antimony and manganese deposits. zinc, antimony and manganese deposits. They are from the Mitsui, Mitsubishi, Dowa, and Nippon mining companies, with arrangements made by the Japan Mining Industry Association in Tokyo. If the mission should succeed in confirming any definite ore reserves, Japan hopes to



velopment of the deposits.

#### LATIN AMERICA

ARGENTINA—A 20,000,000 Peso tungsten refining plant is being built near Valcheta Station, Rio Negro, with help from the Argentine Industrial Bank. The plant, which belongs to Minera Alumine S.A., will operate with machinery being imported from Denver, Colorado. Once finished, it will enable 75 tons of tungsten to be processed daily on round-the-clock shifts. Part of the cost of construction is being financed by the Industrial Bank jointly with the Mining Section of the Ministry of Commerce and Industry.

send another team to arrange for the de-

CUBA—The Economic and Social Development Bank (BANDES) a government agency organized to stimulate industrial activity in Cuba, has authorized a loan up to \$7,400,000.00 to the Cia. Operadora Rometals, S.A. The company plans to install a sulphuric acid plant at the port town of Santa Lucia in Finar del Rio Province. The new plant will use iron pyrite as raw material and will employ a special chemical process to recover copper, lead, gold, and silver from the residues. The daily production of the plant is estimated at 300 tons of sulphuric acid, most of which will be used in Cuba. The contract for the installation of the plant has been granted to Krebs and Cia. who will also train the Cuban personnel. It is expected that a number of dormant iron pyrite mines in Pinar del Rio and other provinces of the island will be shortly reactivated to supply the feed for the plant.

MEXICO-Freeport Sulphur Company has signed an agreement with Sulphur Exploration Company of Houston, Texas for the right to undertake further drilling on Sulphur Exploration's Mexican concession in return for a share of the profits if any commercial quantities of sulphur are found, Freeport is to drill at least 26 wells during 1958 on the 29,000-acre concession on the Isthmus of Tehuantepec in southern Mexico. Work will be concentrated particularly in the southeast part of the concession where previous drilling has shown a substantial sulphur formation. The agreement is actually an extension of a contract negotiated a year ago under which Freeport has already drilled 20 test wells. If commercial deposits are found, Freeport will finance construction of plant, and handle marketing of the product for a share of the

PERU—Consolidated Guayana Mines has been reorganized and will now be known as Latin American Mines Ltd. The Chavin mine will be maintained on a shut-down basis until higher metal prices enable reopening of the property, developed on four levels, are estimated to be 301,000 tons averaging 8.3 percent lead, 11.4 percent zinc, 1.0 percent copper, and 4.0 ounces silver per ton, Exploration at the company's Tintaya copper prospect in southern Peru has been good and these claims will be maintained in good standing until improvements in transportation and construction of a copper smelter are carried out. An option on the Tapo nickel

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prospect in central Peru has ben dropped. Geological mapping and limited drilling were completed on the *Huarca* copper prospect near the Tintaya but this may not justify additional work. An option has been acquired on a copper property of the sedimentary type at Yactabamba. No work was done on the *Aguas Verdes* copper, *Carhuarazo* and *Orcea* copper-silver prospects last year.

BRAZIL—The Brazilian government has decided to assist the St. John d'El Rey Mining Company, the only company in Brazil which has been producing gold on a large scale. With this assistance, it will now be possible for the company to continue its activities, and provide means for the company to explore all other deposits in the company's concession area. The mine has been operating in difficult economic conditions (12 grams of gold per metric tons of ore). Production has been about 260 kilograms of gold monthly.

CHILE—The Tocopilla Copper Mine, one of the country's medium-sized producers, reportedly has stopped work because of the low copper prices.

MEXICO—Operadora Minera del Golfo S.A. has been in operation during the last few months developing barite ores in the Galeana district of the state of Nuevo Leon, and exporting them through Brownsville, Texas. The firm has requested a tax exemption from the Federal Govérnment in order to install a 300-ton-per-day flotation mill. This would be the first plant installed in Mexico for treatment of this kind of ore. W. Flocks is president of the firm and offices are in Saltillo, state of Coahuila.

PERU—Southern Peru Copper Corporation has signed a \$2,000,000 contract with the Lock Joint Pipe Company of New Jersey, in conjunction with A & F Wiese S.A. of Lima, for installation of water pipelines at the Toquepala copper project. Work is scheduled to start soon on the construction of a pumping station to bring water to the mining camp over the 80kilometer rugged terrain from Lake Suche,

CUBA—Banco de Fomento Agricola e Industrial de Cuba (BANFAIC) has just completed a one-month survey of the Los Cerros copper and zinc mine of Minera Industrial Los Cerros at Fomento, Las Villas. A two-month geophysical and geochemical program is to follow in an attempt to locate another ore body and establish enough reserves to reopen the concentrating plant which has been closed for several months. The mine and plant were originally financed by BANFAIC.

JAMAICA—A new mining firm, International Metals Limited, has acquired all shares of the Mavis Bank Mining Company which includes mining leases and exclusive prospecting permits on approximately 7,000 acres in St. Andrew Parish, a few miles east of Kingston. The firm believes a substantial deposit of iron ore exists in the concession and tests are being made to confirm this. Other areas on the concession show indications of copper. The new company was formed by Arturo Peralta-Ramos, president; Desmond H. Morris, executive vice president; and John A. Wood, vice president. Mr. Peralta-Ramos and Mr. Morris are president and executive vice president, respectively, of Compania Minera Purisima, a copper mining firm, and Cia. Minera Peralta, S.A. de C.V., a mercury mine, both in Mexico.

VENEZUELA-Minero Ferroviaria de Venezuela C.A. (Mivenca) has been formed to develop the El Trueno iron mines in the state of Bolivar, about 54 miles south of Puerto de Moitaco on the Orinco River. The development program calls for construction of a 95-mile railroad to a point near Ciudad Bolivar and development of port loading facilities there. Estimated cost of the project is \$52,000,000. According to Transwestern de Venezuela which owns the deposits and fermed the company, more than 150,000,000 tons of iron ore have been proved within the 14,826-acre concession.

CHILE—El Algarrobe iron mine will be developed by a new firm formed by the Dutch firm of W. H. Muller, together with Compania de Aceros del Pacifico (CAP) and American Overseas Finance Company. The government had first granted sole development rights to the Dutch company but strong opposition forced the new arrangement. According to the new agreement, the three groups will form a new company which will purchase the Muller interest in El Algarrobe. CAP will hold 51 percent of the stock and the other two groups will divide the remaining 49 percent equally. Between 1960 and 1973 it is expected that 14,000,000 tons of ore will be shipped. Between 1963 and 1973 CAP will be guaranteed 5,200,000 tons for its Huachipato steel mill. After 1973, CAP will have an option to purchase the shares belonging to the other two members.

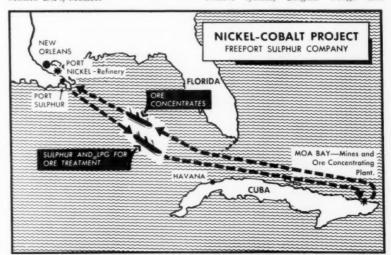
MEXICO—The fourth edition (1957) of "The Mining Laws of Mexico" is now on sale for 87.50 pesos or \$7.00. Copies may be obtained from Paul C. Escalanta, Publisher, PO Box 20931, Admor. 32, Mexico D.F., Mexico.

EUROPE

CZECHOSLOVAKIA—Development of a 100,000,000-ton magnesite deposit near the Russo-Czech border is reportedly underway. It is believed that there are additional deposits located in the same

SPAIN—A new company called Aluminio Galicia has been established at La Coruna in northern Spain by the Aluminio Espanol and Erle Companies in collaboration with several banks: the Banco Espanol de Credito, Banco Central, Banco Pastor, and Baco de Santander. The 30,000,000-peso plant will be designed to produce aluminum at the rate of 20,000 metric tons annually. It is reported that the new company will work with the French concerns, Pechiney and Ste d'Exploitation et d'Interest Chimiquez (Seichime), and the Swiss firm, SA pour l'Industrie de L'Aluminium.

UNITED KINGDOM—The International Tin Council has announced plans to limit the export of tin from member countries, with a total of 27,000 long tons of tin to be exported by the six main producing countries during a 3-month period. This is a reduction of about 28½ percent of the countries' production for the 12-month period ending September 30, 1957. According to the control system, Belgian Congo and



#### First Ore "Tanker" Links Freeport Operations

A trans-Caribbean ferry service connecting Freeport Sulphur Company's refinery at Port Nickel, Louisiana with its subsidiary nickel-cobalt operation at Moa Bay, Cuba will begin operating in mid-1959. A contract has been signed by Freeport's subsidiary, Cuban American Nickel Company, and the States Marine Corporation for conversion of a vessel to carry ore concentrates in slurry form from Moa Bay to the refinery, and return with a carge of liquid sulphur and liquid petroleum gas for use in the Cuban concentrating plant. This will be the first vessel constructed to carry bulk solid products in a slurried form which is easily pumped. To keep the slurry properly mixed for loading and unloading by pipeline, two agitators will be provided on shipboard to service the eight rubber-lined concentrate tanks. The vessel will be designed to accommodate 500 tons of dry cargo, as well as the pulp and liquid shipments. The conversion project is expected to take five months. George G. Sharp Company will serve as consultants on the project. Production from the Moa Bay properties is expected to begin in mid-1959, and annual output of 50,000,000 pounds of nickel metal and 4,400,000 pounds of cobalt metal is anticipated.

Ruanda-Urundi will export 2,416 long tons; Bolivia, 5,516 long tons; Malaya, 10,125 long tons, Nigeria, 1,442 long tons; Indonesia, 5,516 long tons; and Thailand, 1,985 long tons.

RUSSIA—Russia has offered to give 50 kilograms (110 pounds) of uranium 235 to the Atoms-For-Peace pool of the new International Atomic Energy Agency. The offer was made by Professor V. S. Emelyanov, member of the Soviet Academy of Sciences. The United States has promised at least 5,000 kilograms and additional materials have been offered by Portugal, Brazil, Britain, Canada, and Yugoslavia.

GREECE-A \$100,000,000 to \$120,000,000 project, based on the processing of Greek bauxite, is currently planned by

the Greek government. It is reported that Greece now exports about 500,000 metric tons of bauxite annually, earning the equivalent of \$3,000,000. If this raw material could be processed in Greece, equivalent aluminum exports would earn approximately \$50,000,000. Two American companies, Kaiser Aluminum Corporation and Reynolds Metals Company, have reportedly shown a great deal of interest in the project.

RUSSIA—Discovery of wolframite deposits in the eastern part of the Aginsk-Buryat-Mongolian national area beyond Lake Bailkal, has been reported by Russian officials. Geological survey parties are now investigating the deposits. Research has indicated that the ores contain a large proportion of quicksilver in addition to

wolframite. Managanese ore deposits discovered near the center of the Aginsk area

are also being investigated.

GERMANY—Herr Friedrich Flick, German industrialist who controls the Daimler-Mercedes Works, recently obtained uranium concessions in Bavaria. Although the ores are very low grade in comparison to American and Canadian ores, they are important in Germany at this time.

AUSTRIA—A fifth blast furnace is now in operation at Voest, Linz. However, since one furnace is now being overhauled, the steel works will remain on a 4-furnace operation basis and monthly output will continue at 120,000 tons.

UNITED KINGDOM-Minerals Recovery, Ltd. has halted operations at its plant near Gwithian, Cornwall, where beach sands are processed for tin recovery.

AUSTRIA—An all-time record in iron ore production, more than 3,000,000 tons, was reported by Alpine Montangesselschaft at Erzberg in 1957. Average ore extraction per day was 10.641. This is an 8 percent increase over 1956 production.

UNITED KINGDOM—The Geophysical Prospecting Company, Ltd. of London, England has joined with the Canadian Aero Sercice, Ltd. of Ottawa, Canada to form a completely integrated air and ground exploration service for oil and mining industries. The two companies will perform airborne geophysical surveys by magnetometer, scintillation counter, electromagnetic detector, as well as magnetic, electric, gravimetric, and seismic surveys. Other services available include self-potential and geo-chemical surveys; radioactive and geological surveys; electro logging and structure drilling; and soil studies and other photo interpretation. Headquarters of the two companies are located in London, England.

YUGOSLAVIA—The Aluminum-Combinat Titograd, now under construction, has received a \$175,000,000 loan from the Soviet Union. The plant is scheduled to begin operations in 1960 with an initial capacity of 50,000 tons yearly. Production is later expected to increase to 100,000 tons of raw aluminum per year.

ITALY—Encouraging results in the search for radioactive ores in various parts of Italy has been reported by SOMIREN, a subsidiary of the Italian State Oil Agency ENI. Exploration is underway at Trentino (Val Daone and Val Rednina) and Calabria. In the Preit area, Cuneo Province, tunnelling and open-pit mining have revealed the deposit to be much larger than originally anticipated, and the first specimen of uranium-bearing ore has been extracted.

UNITED KINGDOM—Hydraulic Tin, Ltd.'s reconstructed and enlarged plant at Truro, Comwall has begun operations. The plant is treating tailing for the recovery of cassiterite. The new flowsheet utilizes washing and screening to eliminate waste material, followed by classification and gravity concentration.

SWEDEN—The Boliden Company is developing a 3,000,000-ton lead deposit at Idre, Dalecarl province, in Central Sweden. Mining of the 5.0 percent lead ore is scheduled to begin within the next three years and production is estimated at 150,000 tons of ore annually.

NORWAY—The Norwegian Iron Works at Mo i Rana has secured contracts for the sales of approximately 200,000 tons of iron and steel to be produced in 1958.



For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes. Production in 1957 was approximately 170,000 tons. New markets are being developed in South America, especially Argentina where the demand for Norwegian steel products is growing, as well as in Great Britain, the United States, and India.

RUSSIA—Soviet geologists claim to have charted deposits in the Kursk-Belgorod basin (350 miles south of Moscow) with enough iron ore to keep the world's iron and steel production continuing at its present rate for two centuries. Both underground and open-pit mines reportedly have been developed in the basin and large-scale mining is expected to start next spring. Because of the thick overburden of water-saturated clay, artificial freezing methods are used to sink the shafts. Main shafts are sunk through nearly 200 yards of frozen earth, then reinforced with iron tubing.

BELGIUM—Production of nickel-cobalt matte by the Societe Metallurgique de Hoboken of Antwerp is scheduled for 1960, following completion of preliminary studies of the project. Equipment has also been installed to treat copper-cobalt matte, according to recent reports, and the production capacity of cobalt salts has already been increased. The company is now considering installation of facilities for the vertical casting of copper for the manufacture of large electrolytic copper sheets.

SWEDEN—An all-automatic remote control signalling system for railway traffic in underground mines has been installed by the Malmberget Mines in Arctic Sweden. The system, said to be the only one of its kind in the word, controls every foot of the one-mile-long railway and is used to inform the control board of defects in cables, rails, and switches, report the presence of a train on the track, and regulate the traffic light. It was designed and installed by Seenska AB Tradlos Telegrafi of Stockholm.

SPAIN—A large number of requests for permission to prospect for ore in Almeria, Badajoz, Cacedes, La Coruna, Lugo, Oranse, and Pontevedra have been filed recently. According to Spanish officials, 57 requests have been received for iron ore prospecting, 21 for tungsten, 17 for tin, four for copper, four for lead, and one for gold.

SWEDEN—Low tungsten prices caused the tungsten mine in Tiaellmo, near Linkeoping, south of Stockholm, to discontinue operations at the end of 1957, Recent production at the mine had proved unprofitable, and it is reported that the deposit is nearly exhausted.



UGANDA-Kilembe Mines Ltd. plans to increase its copper output to 1,000 tons per month by the end of this year. An additional mill unit will be installed at Kilembe to handle 15,000 tons of oxide ore per month in addition to the present 45,000 ton capacity of the existing plant. The extension, which is planned to effect an overall saving on Kilembe's production costs will raise monthly blister output by some 300 tons.

TANGANYIKA-The Mbeya Exploration Company Ltd., jointly owned by

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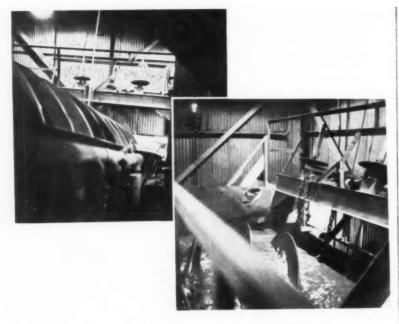
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N. V. Billiton Maatschappij and the Colonial Development Corporation, is operating a 9-foot Aerofall mill in its pilot plant at the Panda Hill columbium-bearing pyrochlore deposit. Treatment rate is 150 to 200 tons a day. The company hopes to be producing 2,000 to 5,000 tons of concentrates annually by 1962.

UNION OF SOUTH AFRICA—Operations are being expanded in gold-bearing deposits about 11 miles from Letaba, in northeastern Transvaal, which were originally developed about 60 years ago. High values were then obtained, and, according to an announcement from the operating company—Inyoni Mining and Exploration Company Ltd., have been obtained in limited operations to date. Results from the property, which extends about 7½ square miles, will be watched with interest.

FEDERATION OF RHODESIA & NYASALAND—Rio Tinto Ltd. has decided to discontinue underground development at its Empresa Nickel prospect where a pilot plant has been erected, and to place the property on a care and maintenance basis. Surface exploration will continue, however. The decision was based partially on the uncertain outlook for nickel.

NIGERIA—Restrictions imposed on tin exports by the International Tin Council have resulted in large-scale unemployment of mine workers in Nigeria. The Council has announced export controls on all producing countries; in the case of Nigeria it will be allowed to export only 1,442 tons of tin ore in the first three-month period, which is less than normal exports in one good month. If the control is maintained, it would mean that Nigeria would be allowed to export 5,768 tons in one year, while exports in 1956 totaled 13,364 tons.

TANGANYIKA—Tanganyika Diamond and Gold Development Company Ltd. reports that its recent installation of scrubber equipment at the main washing plant has facilitated treatment of both run-ofmine gravels and large quantities of old pan tailings and oversize which were previously discarded. The additional recovery in diamond size and quality indicates that certain of the dumped material may be regarded as potential ore reserves. The old pilot plant has been equipped with a scrubber, and will be used as a test plant to gain more detailed information on the value of the property. The original main plant, closed down some time ago, is being replaced by a new modern plant which will double the existing washing plant.

UNION OF SOUTH AFRICA—V. R. Nicholas of Port Elizabeth has signed a contract with an unidentified large mining group turning over most of his rights to titanium deposits near East London. The agreement provides that work must start before July 1, 1958. The area covers about 5,000 acres north of East London and an investment of £1,750,000 is regarded as necessary.

FRENCH WEST AFRICA—Cie. des Minerais de Fer Magnetique de Mokta-El-Hadid reports it is making favorable progress with its exploration program for manganese ores in the Ivory Coast area. It seems likely that a medium-sized manganese deposit will be outlined soon. The company is reported to be on the verge of forming a new firm to investigate a uranium deposit which it located in the Gabon.

UNION OF SOUTH AFRICA-Western Holdings Ltd., in its No. 3 shaft being sunk to open up the western section, intersected the Basal Reef at a depth from 2,945 to 2,958 feet; the complete exposure around the perimeter averaged 262.38 dwt. over 12.44 inches or 3,264 inch-dwts. The completion of this shaft will provide for an eventual monthly milling rate of 150,000 tons a month, compared with the most recent tonnage of just less than 100,000 tons. As development stoping are extended beyond the present workings, and particularly into the northern section, the mill grade and yield should rise.

FEDERATION OF RHODESIA & NYASALAND—Maguadi Copper Mines and Minerals Ltd. has been placed under judicial management following inability to discharge liabilities amounting to over £ 100,000 (\$280,000). The company owns the Mtuga copper mine, about 100 miles south of the Copperbelt, which came into production last March. Although only a small mine, with a production of around 600 tons of concentrate per month containing about 180 tons of copper, it is notable as being the only copper mine in Northern Rhodesia not under the control of one or other of the two big mining groups. Operations are to continue under judicial management as the company is optimistic that, if payment of the present liabilities be deferred, it will be possible, within a reasonable period, to discharge its liabilities in full out of trading revenue.

EGYPT—Deposits of manganese estimated to contain enough for an annual production of about 100,000 tons of ore may be developed by a special company to be set up by the Minister of Industry. Geological missions have been examining the deposit which is located in the southern part of the Sinai Peninsula. According to the Ministry, a number of programs have been proposed which would add substantially to the Egyptian economy. Besides the manganese development, there are projects for development of iron ore, zinc, lead, tin, black sands, ilmenite, chromium, and other mineral deposits. Most recent discovery was made at Om Gheig where lead and zinc were found. Egypt imports both of these metals at the rate of about £250,000 annually.

NYASALAND—The litigation between American Metal Company and American Potash & Chemical Corporation over interest in American Lithium Chemicals, Inc., has been settled out of court. American Metal had claimed that in addition to its 10.604 percent indirect interest in American Lithium held through Bikita Minerals (Private) Ltd., it had the right to acquire one-half of American Potash's 50.1 percent direct holding in American Lithium. This would have reduced American Potash's interest in American Lithium to 35.654 percent, including the 10.604 percent it held indirectly through Bikita. The settlement was accomplished through the sale by Bikita of all but a fraction of its 49.9 percent interest in American Lithium to its stockholders. This results in American Potash holding a 53 percent direct interest in American Lithium, Selection Trust Ltd. 24.75 percent, and American Metal 18.03 percent. All three share in financing of Bikita which is developing a large lithium-bearing deposit near Fort Victoria, Southern Rhodesia.



WESTERN AUSTRALIA—Westralian Oil Ltd. expects to have a concentration plant in operation by next September at Yoganup. An agreement has already been negotiated with C. Tennant Sons and Company of London to organize export sales. The firm estimates it will have a yearly profit of £533,000 from the output of 100,000 tons of beach sands minerals: ilmenite, zircon, and monazite. Mining and separation plants are expected to cost about £500,000. Concentrates will be transported by road to Capel, on the railway between Bunbury and Busselton, where the mineral separation plant will be built. 1,700 drill holes and 53 shafts were sunk in testing the area, the total footage being 63,560; 11,900 samples were tested. Concentrate production is estimated at 74,630 tons of ilmenite per year of 59,6 percent TiO<sub>2</sub>; 8,200 tons of ilmenite of 75 percent TiO<sub>2</sub>; 14,000 tons of zircon; 1,170 tons of monazite.

REPUBLIC OF THE PHILIPPINES

—Atlas Consolidated Mining and Development Corporation has installed additional pumping capacity at its Sigpit River pump station in order to counteract a continuing water shortage. The latter problem accounted for reduced production from the operation in November when the Toledo mill treated only 335,-594 tons of ore. This ore averaged 0.64 percent Cu and yielded 6,299 tons of copper concentrates containing 3,312,838 pounds of copper and 781 ounces of gold.

NEW CALEDONIA—Societe Le Nickel's expansion program is being increased even more. The original goal of 22,000 tons capacity by the end of 1958 has now been expanded to 27,000 tons of metal by 1960. The additional tonnage will come from an increase in the capacity of the ferronickel plant now under construction at Noumea. This, in turn, is made possible by the increased power which will come from a 25,000-kw coal-burning power station. The expansion includes an increase in refining facilities at LeHavre, France from 7,000 tons to 15,000 tons a year.

NORTHERN TERRITORY — United Uranium N.L. has purchased the surface plant of Northern Hercules N.L. for an issue of shares. Ore from El Sherana and other South Alligator River mines will be treated in the new plant after modifications are made, instead of building a special plant in the South Alligator area. This will enable United Uranium to commence production of uranium oxide more quickly and at a cheaper capital cost. Offsetting these favorable factors will be the operating cost of hauling ore about 40 miles along a good road. South Alligator Uranium N.L., working in the same area, has located 5,000 tons of ore to date in its Rockhole mine and a trial shipment will be made to United Uranium's present gravity mill.

REPUBLIC OF THE PHILIPPINES—Marsman and Company, operating agents for Itogon-Suyoc Mines Inc., have announced the completion of the reopening of the caved-in drain tunnel in the Suyoc mine. This project, which took two years to complete, will greatly reduce the

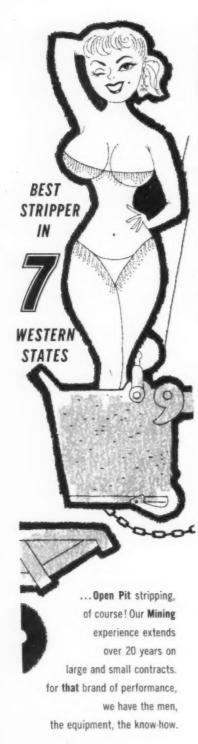
head against which water will have to be pumped from lower levels and will facilitate delivery of ore to the company's mill. Latest reports from the *Itogon* property indicate that mill operations are satisfactory and that the mill is gradually reaching its goal of treating 650 tons daily. In the first half of November 1,665 ounces of gold were recovered.

QUEENSLAND—Mount Morgan Limited at Mount Morgan is fighting one of its too-frequent battles against costs due to a decline in metal prices. The low grade copper-gold ore leaves very little margin under present conditions and mill throughput has been stepped up from 1,400 to 2,000 tons per day by modifications to plant although with some sacrifice in metal recoveries. In three months to end of September, 190,700 tons of ore yielded 11,850 ounces of gold and 1,600 tons of copper. The potential value of pyritic ore reserves continues as the company's main hope and it is planned to establish an ammonium sulphate plant at £8,000,000) can be obtained. The company hopes that Queensland. Sugar interests will provide a large part of this sum.

INDONESIA—The Biro Perantjang Negara (State Planning Bureau) has received a complete report from the West German consulting bureau Wedexro about results of exploration and research conducted on iron ore deposits in Djampang Kulon (south of West Java), Lampung (south of Sumatra), and south east Borneo. All of these could be mined and processed economically. The Borneo lateritic ore is most difficult to process but occurs in largest quantity. The Lampung deposit could yield only 30,000 tons of ore annually for 30 years, whereas the Djampang Kulon deposit could provide 40,000 tons for 60 to 70 years. Wedexro advises use of the Krupp-Renn process for separating TiO<sub>2</sub> in ilmenite in the Djampang Kulon deposit. The German experts finished their work in Indonesia last July. The Ecafe expert sent to Indonesia last August to advice the government is also convinced of the success of working these ores. Not yet known is what deposit would be worked first, as well as other particulars.

NEW ZEALAND—The annual report of Kanieri Gold Dredging Ltd., Taramakau, shows that in the period to 31st March the dredge treated 3,772,000 cubic yards in 5,460 hours for a recovery of 9,146 ounces bullion of average fineness 955. Recovery per yard was valued at 6,93 pence (1.16 grs.) with working costs 5.08 pence. Values were reduced because the dredge passed through old sluicing tailings and ground which had, in parts, been worked by small dredges many years ago. Since March, the dredge has treated 2,188,000 cubic yards for 6,396 ounces of bullion. It is expected that value of ground dredged will increase still further in the coming year. Meanwhile, another dredge has closed down, the small unit of Snowy River Gold Dredging Ltd. having ceased operations. New Zealand gold dredging, like that in New Guinea, will soon be only a chapter in history.

TASMANIA—Proving of the recently discovered ore body at Queenstown by Mount Lyell Mining and Railway Company Ltd. is expected to take two to three years. It is a long, narrow, and fairly deep anomaly adjoining the old North Lyell and Crown Lyell workings. Drilling continues to give erratic values but



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some copper intersections are as rich as any obtained since the North Lyell mine was in production. If the deposit turns out as well as hoped, it will require underground mining methods for development.

INDONESIA—The municipal government of the city of Tjirebon in western Java plans to mine on a large scale the asphalt occurrences in limestone in the Keromong Mountains in the regency of Tjirebon. This deposit was located last year. The asphalt will be used for road construction and is of good quality. Until now, the asphalt had been mined by local people and sold to the government.

NORTHERN TERRITORY—Australian Uranium Corporation's uranium mine at Adelaide River is on a caretaker basis and under exemption from labor conditions pending examination by possible purchasers. During development, 3,415 tons of ore were delivered to Rum Jungle treatment plant averaging 0.52 percent U<sub>3</sub>O<sub>8</sub>, despite considerable dilution. Rum Jungle is only 31 miles away by highway. The Atomic Energy Commission is now unwilling to offer or obtain financial support for private uranium companies, believing that sufficient uranium for some years is now in sight.



ONTARIO — Canadian Dyno Mines hopes to have its new 1.100-ton mill in operation by April. The firm has a \$34,-816.070 contract with Eldorado Mining and Refining Company to deliver this amount of uranium precipitates by March 1963. Underground work is proceeding on all five levels of the 1.000-foot shaft at the north end of zone B, and development ore is being hoisted to the surface for stockpiling. The company's property is in the central part of Cardiff Township, about 18 miles south of Brancroft. Ore reserves are estimated at 2.200,000 tons averaging 0.093 percent U<sub>5</sub>O<sub>8</sub>, after 12.5 percent dilution.

MANITOBA—Riobec Mines has signed a contract with G.G.I. Surveys Ltd. for an electromagnetic survey to be conducted on its property in the Moakmystery Lake area. The property was acquired after the results of an airborne

magnetometer survey had been promising. A detailed electromagnetic survey was recommended to locate the sulphide zones, to be followed by diamond drilling when the anomalies were outlined.

NORTHWEST TERRITORIES—Thompson-Lundmark Gold Mines Ltd. is making a new study of the company's original claims near Thompson Lake in the Northwest Territories to ascertain tantalum possibilities. The property was originally operated as a gold mine, and at that time "encouraging" amounts of lithium, beryl, and tantalite were found. There is a 125-ton mill on the property. The operation closed down in 1949 when known ore was depleted.

BRITISH COLUMBIA—The Canadian and British Columbian governments are contributing \$20,000 a month to help keep the *Britannia* copper mine near Vancouver in operation. The money would help *Howe Sound Company*, owner of the mine, to maintain the company-owned townsite. The mine had been scheduled to shut down because of the low price for copper. This would have left 800 men without work in an isolated community where no alternate employment was available.

ONTARIO—Tandem Mines Ltd. of Toronto has acquired a new iron smelting process which opens up the possibility of treating ores high in iron which also contain impurities of titanium, phosphorus, and sulphur. Invented by Dr. Roy A. Halverson of Detroit, the process involves the introduction of an alkali flux in the form of common salt into the oxidizing zone of the reducing furnace in controlled quantities by compressed air. Tandem Mines tested the process on ore from the Madoc area of Ontario, containing about 50 percent iron and between 6 and 9 percent ittanium, plus other common impurities. Six successive tests yielded pig iron with only an unimportant trace (1/10 of 1 percent) of titanium. Analysis showed that all other titanium in the ore had been freely floated off in the slag, which was extremely fluid and did not contaminate the furnace. Tandem Mines is now in the process of acquiring properties with ore suitable for smelting by this process.

SASKATCHEWAN—Potash Company of America expects to have its 3,000-foot shaft completed by the middle of May. It is expected to take most of the summer and early fall to complete surface installations, so production is scheduled to start in late 1958.



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**NEW JERSEY** 

QUEBEC-Consolidated Zinc Corporation Ltd. of London, England has acquired control of Siscoe Mines Ltd. and has assumed its management. In addition to acquiring stock from individual owners, the firm also purchased 350,000 shares outright from Siscoe, M. F. Nicholson, general manager of Consolidated Zinc Corporation of Canada, Ltd., a wholly owned subsidiary, has already been elected a director of Siscoe, Consolidated Zinc is actively engaged in mineral exploration in Canada in association with The Yukon Consolidated Gold Corporation Ltd. in which it acquired a large interest in 1956. Siscoe has silver-cobalt operations at Gowganda, Ontario; its subsidiary, Siscoe Vermiculite Mines, also operates in Ontario, It is expected that Siscoe will now participate in the exploration activities of the two new associated companies.

ONTARIO—The Prospectors and Decelopers Association will hold its 26th Annual Meeting and Convention at the Royal York Hotel in Toronto from March 9 to 12, 1958. This year the Geological Association of Canada and the Mineralogical Association of Canada will join with the Prospectors. Dr. Walter Tovell, Curator of the Geology at the Royal Ontario Museum, is chairman of the technical sessions committee.

ALASKA—Work will continue all winter at the MacLaren River Copper Corporation property 12 miles north of the MacLaren River bridge on the newly opened highway to Mt. McKinley Park. The corporation has a DMEA contract and is working on the first stage which is diamond core drilling to a depth of 410 feet to block out an additional 15,000 tons of ore. Second stage provides for about 600 feet of drift to intersect the ore body at a depth of 500 feet below the surface, and the third stage will consist of a raise with 50-foot levels on the ore body. The corporation is an outgrowth of the copper discovery made by F. S. Pettyjohn Jr. in July 1953. He and his partner, E. O. Albertson, staked 11 claims and a tunnel site. They formed Kathleen-Margaret Mining Company, sold the claims to Alaska Copper Mining Company Inc., and then acquired the property again for non-payment of the purchasing price. It was then purchased by MacLaren River Copper Corporation following its incorporation November 1956. Mr. Pettyjohn is president of the latter firm. Ore now coming from the mine is being stockpiled.

MANITOBA—Following the failure of American Metal Company to exercise its option to participate in the Bernic Lake lithium property owned by Montgary Explorations Ltd. (Toronto), Montgary has announced promising negotiations with a group of Swiss financiers, as well as Canadian groups interested in the pollucite (cesium) ore discovered in the ore body. American Metal is reported to have confirmed both the extent of reserves and the grade of the ore, but to have felt that there was not a large enough market for lithium ores and concentrates. A three-compartment shaft has been sunk to a depth of 306 feet with a main station cut in ore at the 282-foot level. About 1,000 tons of lithium ore (spodumene and amblygonite) have been stockpiled. Montgary plans a flotation concentrator to treat 1,000 to 1,500 tons of ore per day, plus a chemical treatment plant to process the concentrates for

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production of lithium chemical using a new method developed by Scientific Design Company of New York. An estimated 8,000,000 tons of lithium ore has been located. The ore body also carries pollucite, containing cesium and rubidium, and some lepidolite and amblygonite.

ALASKA—Alaska's first uranium mine has been shut down for the winter. Located on Bokan Mountain south of Ketchikan, the mine produced and shipped 20,000 tons of ore for refining at the Daurn Mining Company mill at Ford, Washington. The Kendrick Bay Mining Company, a subsidiary of Climax Molybdenum Company, had shipped four barge loads of ore by the end of October and the last load went in November. Operations for next year will depend upon results of drilling.

QUEBEC – Grangesberg, the large Swedish iron ore company, is said to be investigating a large iron ore deposit of Belcher Mining Corporation Ltd. at Great Whale Bay, west of the Hollinger deposit at Knob Lake. Preliminary investigations of this property reportedly indicate that there are about 1,000,000 tons

of magnetite ore averaging 40 percent

ONTARIO — Silver-Miller Mines Ltd. has converted its LaRose mill which was originally a cobalt plant, to the treatment of silver ore and it is now replacing the original Brady Lake mill. Milling rate is about 200 tons daily. The LaRose mill was originally designed and built as a cobalt producer, then converted to copper processing when the cobalt market collapsed. With the drop in price of copper, operations at LaRose were suspended completely. Now certain changes in the flowsheet have converted it to silver and the company plans to devote its entire mining effort to silver ore.

BRITISH COLUMBIA—French Mines Ltd. at Hedley has started small-scale milling of high-grade gold ore. Production is about 40 tons daily. French Mines is 75 percent owned by Cariboo Gold Quartz Mining Company, Ltd. and 25 percent by Kelowna Mines Hedley, Ltd.

ALASKA—The U. S. Geological Survey has published a reconnaissance geologic map of the Yukon-Kuskokwim Delta. The region described consists of about 21,000 square miles between the Yukon and

Kuskokwim rivers. It is largely a low plain of unconsolidated deposits broken by hills of bedrock. Included are Nunivak and Nelson islands. The report is based on reconnaissance field studies, published and unpublished references, and interpretation of aerial photographs. It is available for 75c at the Geological Survey office at 520 Illinois Street, Fairbanks.

BRITISH COLUMBIA — Cowichan Copper Company Ltd. has completed installation of heavy equipment at its 500-ton concentrator at Lake Cowichan on Vancouver Island. Officials expect to sell all of the concentrate to Japan. O. G.

MacDonald is president.

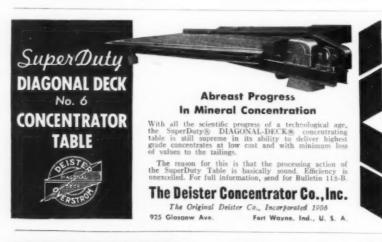
ALASKA—North America's only tin producing mine, belonging to the U.S.  $Tin\ Corporation$ , has been sold at auction as a bankrupt concern. The mine is located 100 miles northwest of Nome on Lost River. Its sale was ordered as a result of a court judgment against the company in a federal government foreclosure. Last shipment of tin concentrates made by the corporation reached Seattle on November 8, 1955, and totaled 240,000 pounds. Located on the Seward Peninsula, the mine is only 90 miles from Siberia across the Bering Sea.

ONTARIO—One of the outgrowths of the recent Commonwealth Mining & Metallurgical Congress is expected to be the formation of a Commonwealth Research Group. Each member country will name one representative. Proceedings will be largely in the form of correspondence, probably with one meeting every four years in conjunction with future congresses. The next congress is scheduled to convene in South Africa in 1961.

QUEBEC—Noranda Mines is continuing its expansion plans with a goal of 130,000 tons of copper a year. Production is now about 100,000 tons with the opening of the third reverberatory furnace. About 25,000 tons of copper comes from the ores of Noranda's Horne mine; the balance comes from custom business and the company's subsidiary, Gaspe Copper Mines. About 24 mines are currently shipping to Noranda.

ONTARIO—The Ontario Department of Mines has completed a mineral map of the province which is believed to be the largest map of the entire province ever to be printed on a single sheet. The map, drawn to scale of one inch to 20 miles, measures 50 inches by 53 inches. Printed in eight colors, it shows the basic geology of the province, and location of principal mines and mineral occurrences. The map is available from the department at \$1.00.

ALASKA—The U. S. Geological Survey has released two maps which will be of interest to Alaskan prospectors. One is entitled "Preliminary geologic map of part of Bokan Mountain uranium-thorium area, Alaska", and represents work done primarily for the U. S. Atomic Energy Commission. It covers an area of about 15 square miles near Bokan Mountain on the southern part of Prince of Wales Island. It shows the geologic setting of the Ross-Adams deposits and other uranium-thorium deposits in the area. The second map is the first one of Alaska published since 1939. It is based on all known geology of the Territory. It shows by color and pattern the distribution of 56 units of sedimentary, metamorphic, and igneous rocks ranging in age from pre-Cambrian to recent. Known faults are also delineated.





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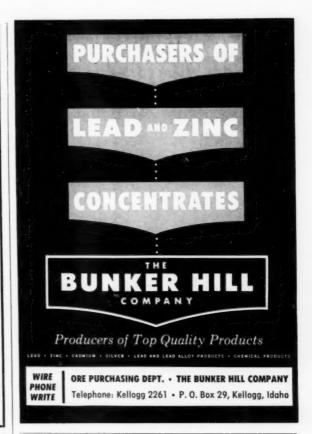
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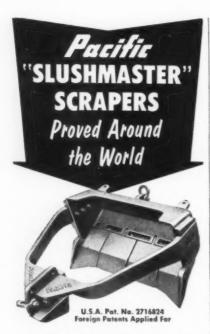
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PLATINUM:	Foreign Handy Harmon
ZIRCONIUM:	Sponge, Per Pound, Reactor Grade
BERYLLIUM ORE:	ORES AND CONCENTRATES  10 to 12% Beo. F.o.b. mine, Colorado
CHROME ORE:	BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$50. F.o.b. railroad cars eastern seaports. Long tons dry weight. African (Rhodesian). 48% Cr.O. 3 to 1 Ratio
COLUMBIUM- TANTALUM ORE:	3.5 to 1. Penalties for grades down to 42° (**c-0).  At United States small lot beryl purchase depots. \$3.40 per pound contained combined pentoxides in 50% one. Includes 100% bonus. Government stopper buying temporarily May 121.  Per Pound Pentoxide. \$1.15.\$1.3'
IRON ORE:	Per Pound Pentoxide.     \$1.15-1.3       Lake Superior. Per gross ton Lower Lake Ports     \$1.15-1.3       Mcsobl, Non Bessemer, \$1.5% Fe.     \$11.4       Mosobl, Bessemer, \$1.5 %, Fe.     \$11.7       Old Range Non Bessemer     \$11.7       Old Range Bessemer     \$11.7
MANGANESE ORE:	ORES AND CONCENTRATES  10 to 12% BeO, F.o.b. mine, Colorado Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at \$400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$50.00, \$6.0.b. railroad cars eastern seaports. Long tons dry weight.  African (Rhodesian), 48% Cr.O., 3 to 1 Retio S.36.00-\$37.00  African (Rhodesian), 48% Cr.O., No ratio S.36.00-\$37.00  U. S. Government ore purchase depot Grants Pass, Oregon, Base price, lump, ore, \$115.00; fines and concentrates \$110.00 for 48%, Cr.O., and a 3 to chromium-iron ratio. Premiums for higher grade are and for a ratio up to 3.5 to 1. Penalties for grades down to 42%, Cr.O., bonus. (Government stope buying temporarily May 12)  Per Pound Pentoxide \$1.15-13.  Lake Superior. Per gross ton Lower Lake Ports  Mesabl, Non Bessemer, \$1.5%, Fe. \$11.4  Mesabl, Non Bessemer, \$1.5%, Fe. \$11.4  Metallurgical grade. 48 to 50%, Mn. Long ton unit \$1.30-\$1.3  Domestic U. S. Government ore purchasing depots: Butte, Montang, 18.10  Domestic U. S. Government ore purchase of the polymous of the polymous canding and printing and
MOLYBDENUM CONCENTRATE: TUNGSTEN CONCENTRATE:	(46%) \$2.30 per unit with premiums and penalities.  90% Md95 F.o.B. Climax, Colorado. Per pounds of contained malybdenum, plus cost of containers.  51.1  Domestic. 60% Wd03 Per short ton unit Government not buying\$55.0  Foreign. 65% Wd0 Per short ton unit (Scheelite)
URANIUM ORE:	(46%,) \$2.30 per unit with premiums and penalties.  90% MeSr. F. B. Climax, Colorado Per pounds of contained molybdenum, plus cost of containers
VANADIUM ORE:	and all contained vsos is paid for Per Pound vsos \$0.3
BENTONITE:	Minus-200-mesh. F.o.b. Wyoming points. Per ton in carload lots \$12.5  Oil Well grade. Packed in 100 pound paper bags \$14.6  Boron, Technical grade F.o.b. Boron, California Per ton . \$47.5
FLUORSPAR:	Boron, Technical grade
PERLITE:	\$34.50 per ton, others \$28.50; 70% IIIKen. \$38.50, others \$32.50.  Crude: F.o.b. mine per short ton
SULPHUR:	Long fon, F.o.b. Hoskins Mound, Texas \$24.00 \$26.00 \$24.00 \$26.00 \$25.00

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TUNGSTEN:	Long ton unit .	* * * * * * * * * * * * * * * * * * * *	925-975	\$12.88-\$13.58
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HOISTS: Mine Shoft
1—800 HP, Norghere double drum. Even

HUS13—Tuggers & Slushers
4—ASNNOH Ingersoll-Rand Slusher, air
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3—HNN1.1 Ingersoll-Rand 2 drum
1—HDE-2 Sallivan, 2-drum, 440 Volt
1—IF-211 Joy Tugger
5—EVA Ingersoll-Rand, Tugger, air
6—E-211 Sullivan Tugger, Turbinalre
1—Bell Ingersoll-Rand Tugger, Air
2—E111 Joy Tugger, Air
1—50MNM4 C Ingersoll-Rand Slusher, 3-drum
LOCOMOTIVES:
1—1½ Ton Mancha, Battery 18" G-

COMOTIVES: 1½ Ton Mancha, Battery, 18" Ga. 2½ ton Greensburg, Battery, 18" Ga. 4-ton Mancha, Battery, 24" 42" Ga. 7-ramaire, Air operated 24" Ga. 4-ton Mancha Diesel, 18" Ga. 4-ton Mancha Westinghouse Battery, 30" Ga.

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2—11 KW Joy D. C. balancer type. 126.5 volts

volts -15 KW General Electric, 146/167 volts -15 KW Electric Products, 132 volts -20 KW Joy, 126.5 volts -22 KW Wotton D. C. balancer type.

132 volts
-50 KW Hertner, 155 volts
-250 Volt D. C. battery charging switch-

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engine driven
engine driven
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1-6 Ton Jeffrey Trolley Locomotive
2-6 Ton General Electric Battery Locomo-

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1-7 for Jeffrey Trolley Locomotive 1-7 Ton Aldas Battery Locomotive 2-8 Ton Geodman Battery Locomotives 2-8 Ton General Electric Battery Locomo-

2-8 Ion detects 2-3
3-8 Ton Ironton Battery Locomotives
1-9 Ton Whitcomb Battery Locomotive
4-10 Ton Atlas Battery Locomotives
2-10 Ton Jeffrey Trolley Locomotives
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AIR TUGGER HOISTS

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2—ingersoll-Rand Model DBU

4—ingersoll-Rand Model IR

1—Sullivan Model E-111

9—ingersoll-Rand Model IO-H

8—Gardner-Denver Model HK

2—loy "Turbinair" Model F-113

1—Sullivan Model L-111

2—ingersoll-Rand Model IO-H

1—Sullivan Model MA

3

3—ingersoll-Rand Model HA

3

3—ingersoll-Rand Model H4

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2—2" Ingersoil-Rand 2 stage motor pumps 150-250, GPM, 325-500 ft. head 1—2" Union 6 stage pumps 150-220 GPM, 510-580 ft. head

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4-21/s" Pennsylvania 4 stage pumps
200-250 GPM-325-520 ft. head
1-21/s" Pacific 6 stage pump
150-200 GPM. 450-680 ft. head
1-3" Allis-Chalmers 3 stage pump
400 GPM. 250 ft. head
2-3" United 5 stage pumps
110-350 GPM. 550-700 ft. head
3-3" United 6 stage pumps
110-350 GPM. 700-500 ft. head
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340 GPM. 500 ft. head

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